AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

AUGUST 14, 1937

Where GOOD DESIGN *is never good enough!*

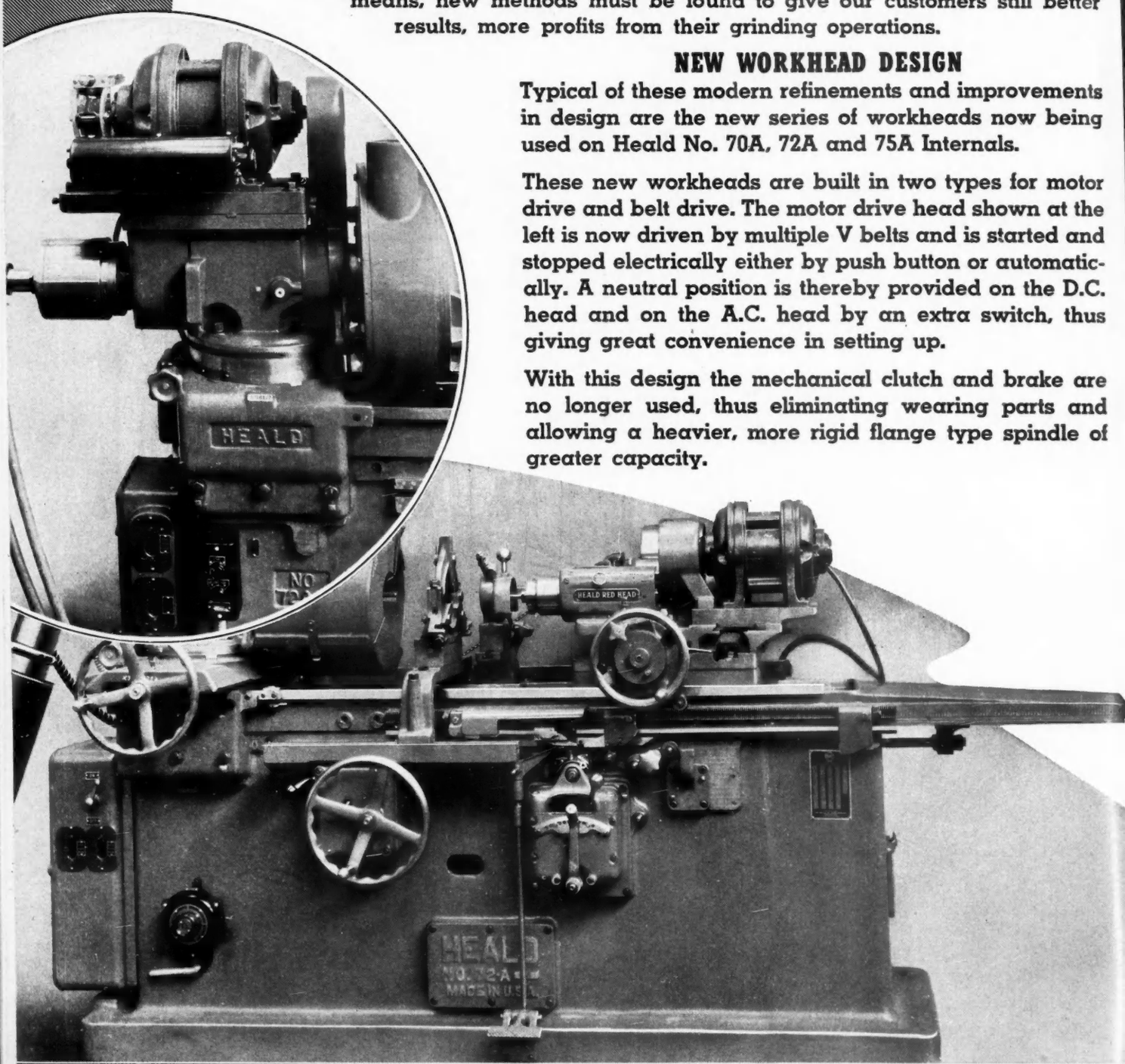
A paradoxical statement but nevertheless true! For Heald Internal Grinding Machines, even with a record of accuracy, productivity and ease of operation unrivalled by any other grinder and which has proven the soundness of their design, are nevertheless subject to continual change . . . because here at Heald's good design is never good enough . . . new means, new methods must be found to give our customers still better results, more profits from their grinding operations.

NEW WORKHEAD DESIGN

Typical of these modern refinements and improvements in design are the new series of workheads now being used on Heald No. 70A, 72A and 75A Internals.

These new workheads are built in two types for motor drive and belt drive. The motor drive head shown at the left is now driven by multiple V belts and is started and stopped electrically either by push button or automatically. A neutral position is thereby provided on the D.C. head and on the A.C. head by an extra switch, thus giving great convenience in setting up.

With this design the mechanical clutch and brake are no longer used, thus eliminating wearing parts and allowing a heavier, more rigid flange type spindle of greater capacity.



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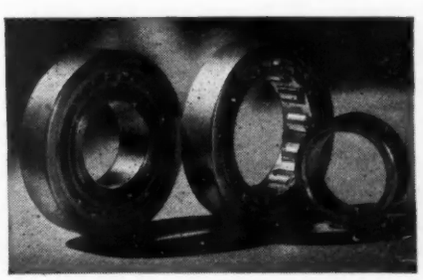

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Contents

C. A. MUSSELMAN, Pres.; J. S. HILDRETH, Vice-Pres. and Manager, Automotive Division; G. C. BUZBY, Vice-Pres.

OFFICES

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AUTOMOTIVE INDUSTRIES

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Plan 100,000 1937s in September

Half Dozen Plants Down Already for Model Changes But Ford and Chevrolet Are to Continue Next Month

The automobile industry will have built more than 5,000,000 of its 1937 models when the last of this series comes off the assembly lines. It had an estimated 455,000 units to go on Aug. 1. and output this month should account for upwards of 350,000 vehicles, leaving some 100,000 units of the current series to be built next month to reach that goal.

There are well over 100,000 of the 1937 cars scheduled for production in September by the few companies that still will be operating on old programs. Both Ford and Chevrolet are among the producers to run over into next month. But another four weeks should see the final wind-up of production on the current passenger car series. Truck manufacturers, as a rule, carry on to the end of the calendar year before changing models.

Because of this variation in the model year of the two divisions of the industry, and the difficulty in segregating new and old series production during changeover months, figures can represent only rough estimates. If we consider the start of 1937 passenger car production last September as the opening of the current model year for the industry, then total output up to the end of July was 4,550,000 vehicles of which 1,183,000 or nearly 24 per cent were built in the last four months of 1936.

Had not two of the three weeks the Ford plants were closed fallen in July, last month's output would have gone far beyond that of July, 1936. Last year Ford closed on Aug. 10 for one week. Ford production should contribute about 84,000 units to this month's total. Operations were resumed Monday on current models with the schedule calling for 6000 units daily, four days a week.

A half dozen plants are now out of production while changing over to 1938 models on which some hope to get under way before the end of the month. Another plant will fall out during the coming week and three or four more should complete their 1937 programs by the end of August. Plants now out of production are Packard, Nash,

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UAW March Uneventful

New Ford Drive Quiet Affair; Friction Appears in Union

No disorder accompanied the UAW's second distribution of union literature at the Ford Rouge plant, Aug. 11. But the unionists were not without trouble. A heavy downpour interfered somewhat with their activities and a dispute over bus transportation also helped delay them. The union had chartered a fleet of DSR buses to transport the 800 members who were to participate, but Dearborn city officials refused to allow the special buses on roads passing the plant gates during the rush hours when shifts are changed. Private automobiles and taxicabs were then resorted to.

A relatively small percentage of Ford workers accepted the union paper and leaflets and many of these immediately threw them away.

The march on Ford brought to light friction that exists within the UAW. Walter Reuther, head of the powerful West Side Local, had planned to lead the march but was called back to Milwaukee under threat of suspension. Reuther and Ed Hall, who are leaders in the faction opposing Homer Martin, had flown from Milwaukee to Detroit for the Ford distribution, but after being notified that the executive board

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Summer Shipments Dip Wide

July factory shipments of automobiles and trucks were 445,550 units, it was estimated by the Automobile Manufacturers Association. This was a decline of 1 per cent from the figure of 451,206 reported for the same month of last year. June shipments were 521,139, the decline therefore reaching 14.5 per cent. Last year the decline from June to July was 3.8 per cent.

Shipments for the first seven months of the year were 3,362,970, a 10 per cent gain over 1936 when the figure was 3.045.714, and the largest seven months' shipments on record excepting for 1929.

L. B. MANNING

Cord's Holdings Sold

L. B. Manning and Bankers Buy His 30 P.C. of Cord Corp.

Working control of the Cord Corp., holding company which itself controls a number of units in the automotive field, has passed to a banking group acting in conjunction with L. B. Manning, who for years has been a close friend and business associate of E. L. Cord. Mr. Cord on Aug. 7 agreed to sell his entire stock holdings in the Cord Corp. to the bankers and Mr. Manning for $2,632,000, representing 658,000 shares at $4 a share. The company has outstanding 2,256,700 shares.

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Ayres Urges Caution

Warning to exercise increased caution in extending credits, especially in connection with automobile financing, is contained in a letter just addressed by M. V. Ayres, secretary of the National Association of Sales Finance Companies, Chicago, to its membership of 170 concerns throughout the country. Mr. Ayres explains that "while the credit situation is not alarming, the present economic recovery has been of such nature as to make purchases on lengthy terms with too small down payments unwarranted."

New British Cars Out

Fundamental Changes Are Few; Prices Generally Up

During July four British manufacturers announced their full range of models for 1938; two more introduced new models, one of these supplementary to an existing type, the other displacing a corresponding model that has been current for the past two years. Prices will be up from 5 to 20 per cent.

The new Austin "Big Seven" does not displace the "Baby," which has a 45.6 cu. in. four-cylinder engine*. The new model has a 55 cu. in. engine, a longer wheelbase and wider tread, enabling it to be standardized with a four-door sedan body in place of the two-door type provided on the original "Seven."

Austin's new "Eighteen-Six" displaces a model of the same rating that has been current for several years. Its engine is farther forward and extends farther back under the cowl, which results in an unusually short hood for a car of this size and provides exceptionally good driving visibility. There are two wheelbases, 112½ in. and 123 in., the latter for seven passenger bodies.

Behind the gearbox a short shaft runs back with a rubber-mounted ball bearing in a frame cross member. From this point the propeller shaft continues to the rear axle. The engine has a piston displacement of 153.2 cu. in. and a four-bearing crankshaft. Transmission includes a single-plate clutch and four-speed transmission synchronizing in second, third and high, as with all Austin models from the "Seven" upward. Zinc interleaving and Oilite disks are used for the semi-elliptic springs front and rear. Brakes are Girling mechanicals with a pistol-grip hand lever. Marles-Weller cam steering is provided with an adjustable-length steering column and forward-mounted tie rod. Price increases apply to continued Austin models, ranging from roughly 5 per cent to 15 per cent.

No fundamental alterations have been made in the Standard, Rover and Triumph cars for 1938. The new Hillman "Minx" is on the same general lines as the superseded model. All of these makers, like Austin, have refrained from adopting independent suspension. Prices show an upward trend in all cases except Standard; reductions apply to the latter, some of the new figures being lower than those in force before certain increases were announced a few months ago.

The new Riley "Big Four" represents a trend towards larger four-cylinder engines that will be made evident in several directions before the London Show in October. Apart from this, it has an overdrive transmission, introduced last Spring as an option on then existing models. The synchronizing transmission, with three speeds, gives ratios of 5.5, 8.25 and 14.3. The overdrive can be used in either high or second, giving overall ratios of 3.97 and 6.15. Engagement of the overdrive is effected by momentarily releasing the accelerator at any speed in excess of 42 m.p.h. in high, the change back to high being made automatically at about 35 m.p.h. There is also free-wheeling normally in operation in first, second and high gears, if a control is set for the overdrive to come in. But if the free-wheeling device is locked out the overdrive will not engage.

This new Riley is a high-priced car relative to its size. Riley is the first British maker to offer a modern overdrive transmission, as distinguished from the four-speed transmission with an indirect high, such as that fitted to some of the pre-war Wolseleys.—M.W.B.

*Sectional assembly views of the small engine are scheduled for reproduction in the AUTOMOTIVE INDUSTRIES engineering drawing series, issue of Sept. 4.

June Exports Gain 55.3% Over 1936

Six Months Increase 32.6 Per Cent

The sharp increase in dollar volume of exports in June over the same month last year compared with a gain of 34 per cent in May over May. The gain came in a wide gain in exports of trucks and buses, and of passenger car engines. All sizes of trucks over one ton were represented in the upturn. Trucks of less than one ton capacity were exported in fewer numbers but gained in dollar volume.

	JUNE 1937		JUNE 1936		SIX MONTHS ENDED JUNE 1937		1936	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 29,721,071		$ 19,135,445		$ 176,060,443		$ 132,820,215
PASSENGER CARS								
Passenger cars and chassis	18,157	10,810,678	14,805	8,123,099	123,351	73,049,151	100,473	57,224,066
Low price range $850 inclusive	16,662	9,116,689	13,804	6,945,858	112,404	60,867,415	92,042	47,749,382
Medium range price over $850 to $1,200	1,195	1,130,160	758	731,795	8,900	8,436,171	6,864	6,605,114
$1,200 to $2,000	235	364,491	166	243,919	1,503	2,319,654	1,059	1,552,448
Over $2,000	65	199,339	77	201,527	544	1,425,911	508	1,317,122
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	15,128	9,218,361	9,029	4,727,273	76,265	43,018,018	57,718	29,083,841
Under one ton	1,654	687,484	1,764	675,029	9,232	3,568,077	9,003	3,389,286
One and up to 1½ tons	10,361	5,423,004	5,863	2,603,977	52,586	25,083,942	37,780	17,202,049
Over 1½ tons to 2½ tons	2,273	1,641,989	1,144	868,201	10,456	8,014,365	7,630	5,456,298
Over 2½ tons	612	1,222,868	228	554,504	3,191	5,672,125	1,690	2,346,161
Bus chassis	224	243,036	30	35,562	820	679,509	1,585	690,047
PARTS, ETC.								
Parts except engines and tires								
Automobile unit assemblies		4,710,527		2,683,334		30,608,863		25,436,525
Automobile parts for replacement (n.e.s.)		3,116,583		2,372,591		18,503,379		13,191,212
Other automobile accessories (n.e.s.)		417,665		289,715		2,173,224		1,650,123
Automobile service appliances		626,500		389,080		3,350,800		2,192,941
Airplanes, seaplanes and other aircraft	57	1,341,146	78	2,036,124	287	8,945,251	227	4,577,099
Parts of airplanes, except engines and tires		976,784		511,010		4,276,711		2,351,213
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and semi-Diesel	86	149,471	38	74,255	407	900,404	200	623,347
Other stationary and portable								
Not over 10 hp.	1,019	71,854	1,163	50,582	10,271	574,555	5,703	353,435
Over 10 hp.	325	158,064	148	60,346	1,906	882,789	1,308	471,757
Automobile engines for:								
Motor trucks and buses	1,730	169,859	1,909	196,079	16,870	1,672,189	12,958	1,243,622
Passenger cars	8,857	613,435	4,117	290,508	53,859	3,634,819	29,729	2,023,888
Aircraft	57	275,347	63	195,100	543	3,027,322	328	1,453,495
Accessories and parts (carburetors)		269,102		159,563		1,420,414		998,618
IMPORTS								
Automobiles (dutiable)	179	130,174	83	53,101	738	556,168	357	169,813

New Car Financing Off

Used Car Time Sales Gain As Strikes Cut New Output

Retail financing of new automobiles reached the year's peak in June at $118,322,650 against $117,532,449 in May. The volume was below that for June, 1936, when it was $129,693,697. For six months the volume on new cars was below that for last year, $572,235,258 against $582,797,679. Over 49 per cent of the new cars registered for the six months were financed, while in 1936 it was 54.7 per cent.

Used car retail financing also peaked in June at $74,635,727 against $72,348,814. It was far above the June, 1936, figure of $64,246,543. For six months, used car retail financing showed a wide gain, rising to $373,478,757 against $308,610,668. The proportion of used cars financed showed a wide gain this year as strikes hit new car production.

Wholesale financing for six months also showed a gain, reaching $1,041,285,486 against $955,780,762. June was seasonally below May.

Chevrolet Pupils Graduate

Twenty-two new district managers have taken their places in the Chevrolet sales organization this week, after an intensive six weeks training course in the new Chevrolet school of modern merchandising and management. The new field executives comprised the first class to be graduated from the school, which opened officially in June.

UAW-GM Election Held Possible

Union Wants Exclusive Contract But May Not Risk Strength By Asking for Such a Test Prior to Signing New Pact

By Norman G. Shidle

Will there be an election to determine whether the UAW will represent all General Motors workers before completion of the present negotiations looking toward revision of the Feb. 11, 1937, agreement between General Motors and that union?

This question is being asked with increasing frequency by outsiders who speculate on the outcome of present conferences. So far, it is understood, the conferences have concentrated chiefly on a way to make effective the corporation's demand that the UAW give guarantees that its agreements can and will be carried out. It is believed that progress is being made toward that end. Various signs point to realization by union leaders now in command that such guarantees must be made effective if the prestige of their organization is not to be irreparably impaired.

One of the chief modifications of the February agreement asked for by the UAW is that it be recognized as the sole bargaining agent for all employees. This is as near to a fight for the closed shop or the check-off as seems likely at present. That there will be a strong demand for such recognition, however, seems almost certain. While corporation sources have given no indication of the company's probable attitude, it is logical to assume that it has not changed its mind since the agreement was first signed in February—which means that it would not accede to the demand.

Law Constitutional

The only difference in the situation is that the Wagner law has been declared constitutional in the meantime. Since this law provides definitely that a union chosen in an election by a majority of employees shall be recognized as the bargaining agency for *all* employees, it is reasonable to guess that the corporation might meet the UAW demand by suggesting that the union exercise its right to call for an election, by the results of which both sides would have to abide. The logic of this guess is reinforced by the fact that, in negotiation of the original agreement, corporation officials suggested the holding of an election.

If such an election were held, there seems to be no way of predetermining whether it would be on the basis of individual plants or General Motors as a whole. Decision in this regard would rest with the National Labor Board.

The holding of any election, of course, rests with the UAW, since the employer does not have the right under the Wagner Act to demand an election. Whether the UAW decides to make the election test may give some indication of its own estimate of its chances of success.

Other items which the union has asked the corporation to discuss include a 35-hour week, recognition of the shop steward system, and a study of wage differentials looking toward standardization of wages for given operations in various parts of the country.

Just how seriously the union expects to achieve these various ends only time and the progress of the negotiations will show. There is every indication, however, that union strategy from now on may look toward making General Motors a shining example of how peacefully a union-contracted group of plants can operate. Some observers lay Tom Girdler's winning fight against the CIO largely to his ability to point to continuing General Motors strikes as evidence that CIO agreements were not to be relied upon. There is reason to think that union leaders do not want that to happen again.

Plant Protection Costly

Reflecting a side light on the cost to industry of sitdown strikes, the annual report of the General Motors Corp. filed with the Securities & Exchange Commission shows that GM paid out $196,333 for "plant protection" during 1936. This figure represents an increase of approximately $29,000 in the cost of plant protection compared with 1935 when the amount paid for that purpose, as shown by the GM report, was $167,586. The sitdown strikes began Dec. 21, 1936, and "officially" ended March 12, 1937. The increased cost for plant protection in 1936 having covered only 10 remaining days of the year, the daily cost was about $2,900.

The report showed for 1936 that the Pinkerton Detective Agency was paid $140,863; the Corporation Auxiliary Company received $33,044, and the Railway Audit and Inspection Company, $22,424. The 1935 payment for plant protection was made to only one company, namely, the Pinkerton agency.

FLAME TRAVEL studies are facilitated by the use of a machine developed in the Chevrolet laboratories. It cuts away successive spherical sections from a plaster cast of a model combustion chamber. This aids engineers to determine the best form of chamber without resorting to involved mathematical analyses.

GM July Sales Top June

Contra-seasonal Gain Shown; Dealers Add to Stocks

The late season revival in automobile sales was clearly shown in the General Motors sales report for July. Sales to domestic consumers were actually larger in July than in June, in contrast to the usual sizable seasonal decline.

Dealers were, however, able to add 24,051 cars to stocks as production was kept up at high levels. Presumably, this stock of cars will be needed during the period of model changes where there is very little production.

Export sales held at about the levels of recent months although the July total was a little under that for June.

Details of the July sales report were as follows:

	July 1937	June 1937	July 1936	9 Mos. of Model Year 1937	9 Mos. of Model Year 1936
Sales to domestic dealers....	187,869	162,390	177,436	1,420,163	1,453,569
Sales to domestic consumers.	163,818	153,866	163,459	1,364,068	1,386,967
Change in dealer stocks.....	+24,051	+8,524	+13,977	+56,095	+66,602
Sales to foreign dealers.....	38,812	40,749	27,257	334,722	289,744
Sales to world dealers.....	226,681	203,139	204,693	1,754,885	1,743,313

Plant Notes

A building program calling for the expenditure of approximately $250,000 and adding about 90,000 sq. ft. of floor space to its present plant facilities has been started by the Motor Wheel Corp., Lansing, Mich. First of the new structures to be started is the Centrifuse brake drum production building which is approximately 325 ft. in length by 150 ft. in width. The second building, which is to be ready for occupancy about Dec. 1 this year, is an easterly extension of the present hub shop at Plant No. 2. This building will be approximately 300 ft. by 160 ft. and will house the final assembly operation of Centrifuse brakes. A tunnel approximately 500 ft. long, running north

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Tire Makers Seek Steady Prices

Top-heavy Inventories Held Threat to Structure; Move To Wipe Out Road Hazard Guarantees Entirely

Tire manufacturers at a special two-day meeting in New York Aug. 10-11 under sponsorship of the tire division of the Rubber Manufacturers Association adopted a new 5-point program and promulgated a set of proposals to be submitted to all tire manufacturers in the interests of further stabilization of the tire market. Concerted effort will be exerted, as result of the meeting, it is reported, to strengthen the industry's present price stabilization program so as to avert, if possible, any price war this fall.

Recognizing that top-heavy inventories today stand as a menace to price stabilization, members of the industry committed themselves as in favor of maintaining a rigid control of metropolitan markets, and of continuing a definite price stabilization program. Inventories are unduly large, having been built up during the past year by most manufacturers as a "cushion" in event of future labor trouble. Manufacturers' stocks of finished tires exceed 12,500,000. Car manufacturers have more than 1,000,000 original equipment tires on hand and there are stocks of approximately 7,000,000 casings in the hands of dealers and chain stores and mass distributors.

One of the significant steps taken at the special industry meeting was a "tightening up" on tire guarantee practices. In view of the fact that the two major mail-order houses have deleted the road-hazard feature from their guarantees in new catalogs issued Aug. 1, efforts will be made to have all manufacturers completely discard the road hazard tire guarantee and standardize on the standard RMA tire warranty. The industry banned the road hazard guarantee last February but the ban was weak in several spots.

In an effort to increase the manufacturers' recovery on tire sales and establish this recovery on a legitimate basis, the new industry program provides for an elevation of third and fourth line tire prices so as to narrow the present wide gap between first line prices and third and fourth line prices.

The meeting put in motion a campaign to clean up practices with respect to changeovers particularly on trucks. In many instances manufacturers have been selling passenger car owners and truck operators their tires in changeover for the original equipment tires with which their vehicles were originally equipped, and these changeover tires have been marketed at reduced prices. It is understood the meeting resulted in an agreement that all changeover truck tires shall be branded "S.U." or "Slightly Used" before being offered for resale. It is the hope of the industry to ultimately apply this same provision to passenger car changeovers.

Retail tire sales of tire manufacturers' company-owned stores and of petroleum companies are growing steadily, while the share of the renewal tire market held by independent tire dealers is steadily dwindling. Oil company tire sales in 1936 represented 13 per cent of total units sold against less than 1 per cent in 1929, while company-owned store sales accounted for 12.4 per cent against 4.5 per cent in 1929. Chain stores sold 14.1 per cent of the total market. The share of the market held by independent dealers last year was 54.8 per cent compared with 61.7 per cent in 1934, according to an industry compilation just completed by Prof. Warren W. Leigh, head of the economics department of the University of Akron at Akron, Ohio.

The Leigh survey indicates that mail order sales have declined from 3.6 per cent of total replacement tire units in 1934 to 3.3 per cent in 1936. Department store sales represented about 1 per cent. Cooperatives' tire sales—a minus factor in 1934, account for 0.5 per cent of total sales. Factory direct shipments represent 0.9 per cent. Private brand sales by oil companies have waned while the sale of standard brand tires through oil company outlets has increased.

The Leigh survey places 1936 replacement sales at 28,800,000 tire units compared with 29,300,000 in 1935 and 31,830,000 in 1934. Spare tire sales (not included in replacement sale tabulations) direct by manufacturers to automobile companies, have grown from 10,000 units annually in 1926 to more than 4,600,000 in 1936. The estimate is for more than 5,000,000 in 1937.

Gasoline Consumption Up

California this year once more leads the country in gasoline consumption, according to figures in the American Petroleum Institute bulletin. For five months through May the consumption was 697,323,000 gals. against 652,660,000 gals. for the like period of 1936. New York was in second place, using 672,019,000 gals. against 603,429,000 gals. last year. For the country as a whole, the total consumption for five months was 7,932,636,000 gals., a gain of 12.05 per cent over 1936.

Coil Company Formed

Orland Murphy, president, announces the organization of Electrical Windings, Inc., 16 North May Street, Chicago, to specialize in the design and manufacture of all types of transformers, solenoids, chokes, magnets, etc. The new company is set up to design coils and mountings for any specific purpose, or to work from manufacturers' specifications.

MEMA Index Down in June

Grand index of the Motor and Equipment Manufacturers Association for June dropped to 174 from 181 in May but was well above the June, 1936, figure of 157. Within the index, original equipment shipments to manufacturers fell from 202 to 190 in June, but topped the 1936 mark of 166. Service parts shipments to wholesalers were up to 167 in June from 152 in May and were above the June, 1936, level of 151. Accessories shipments to wholesalers dropped from 103 in May to 99 in June, against 112 a year ago. Service equipment shipments to wholesalers were 154, against 157 in May and 115 in 1936.

Independents Raise Car Prices

Move Now Quite General Excepting for Chrysler Whose Action Is Expected; See Cost Rises Partly Covered

Three independent automobile manufacturers have announced price increases on 1937 models, following the Ford and General Motors moves. Chrysler divisional increases are expected in the very near future. Partial coverage of higher costs is given as the reason.

Packard distributors and dealers have been notified of price increases to be effective at midnight Aug. 16. The "Six" is to be raised $65; the "120," $65; the "Super Eight," $150, and the "12," $200.

Nash and Nash-Lafayette cars are being advanced in price Aug. 14. On the latter the increase is $35. The Nash "Ambassador Six" is going up $65 and the "Ambassador Eight," $85. C. H. Bliss, Nash-Kelvinator Corp. vice-president, announced the suspension of assemblies so that the company's $2,000,000 plant improvement plan can be completed. Production facilities will be doubled at Kenosha, Racine and Milwaukee, Wis. He reported Nash registrations for the first half of the year at 41,698 cars, a gain of 82 per cent over the 1936 results.

Prices of Hudsons and Terraplanes will be increased on Aug. 23, according to William R. Tracy, vice-president in charge of sales of the Hudson Motor Car Company. The increases, Mr. Tracy stated, will range from $35 above the present list price on the Terraplanes up to $45 on the Hudson cars. "Practically every product entering into the manufacture of our cars, including wages, has risen substantially in price Mr. Tracy stated. Naturally, this affects the price of our own product. Present prices are effective up to midnight Aug. 22."

The Chevrolet price increase, effective Aug. 9, was $30 on all passenger and commercial car models, and on trucks. Pontiac raised its cars $45.

Ford Motor Co., Ltd., Canada, announced price increases ranging from $21.21 to $43.16 delivered at East Windsor, Ont., tax included, freight

(Turn to page 210, please)

SHARP CONTRASTS abound in a pictorial study of living and working conditions at a "village" plant of the Riken Piston Ring Co. of Japan. The company's president, Dr. Viscount Masatochi Okochi, believes in education and recreation for the workers to help them better to use their special tools. In the upper left corner are shown checking operations with new electro-limit gages. The upper circle shows the first sorting-out in the foundry, while at the upper right a young girl uses a milling machine. Below, the girl operatives sing the national anthem "Kimi-ga-yowa Chiyo-ni-yachiyo-ni" as the Banner of the Rising Sun is hoisted each morning. In the lower left corner is a ping-pong game in one of the dormitory rooms. The lower circle shows a class in flower arrangement. The girls work half an hour overtime daily to pay the costs of dormitory housing. Working hours are 7 A.M. to 5 P.M. with a 10 min. rest period in the morning and a 40 min. lunch hour. Lights go out at 10 P.M. Many girls make enough over expenses and clothes to buy shares in the company.

The whole plan was an experiment when Dr. Okochi opened the plant. Many of the young girls had never even heard of the machines they were to operate, and some of the results were not satisfactory until special equipment was devised for them to use. His success has been amply demonstrated in the company's earning power and in the dividends paid on its shares.

Shufunotomo Photos

Business in Brief

Written by the Guaranty Trust Co., New York

Business Improves

There was no interruption in the upward movement of general business last week. The weekly index compiled by the "Journal of Commerce" stood at 102.3, as compared with 101.0 for the preceding week, and 92.5 for the corresponding period last year. Retail sales for the country as a whole last week were estimated at 3 to 8 per cent above those in the preceding week and from 8 to 20 per cent above those a year ago.

Loadings Up

Railway freight loadings during the week ended July 31 totaled 782,660 cars, which marks a gain of 11,680 cars above those in the preceding week, a rise of 35,130 cars above those a year ago, and an increase of 187,363 cars above those two years ago.

Production of electricity by the electric light and power industry in the United States during the week ended July 31 was 8.0 per cent above that in the corresponding period last year.

July Movements Seasonal

The "Monthly Review" of the New York Federal Reserve Bank issued on August 1 states that there was no pronounced change in the volume of goods distributed during July, as compared with that in June. However, sales of department stores in the metropolitan area of New York declined by more than the usual seasonal amount.

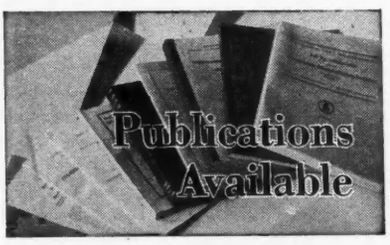
According to a recent report issued by the Department of Labor, employment and payrolls in the United States during July declined below the levels in the preceding month. There was a reduction of approximately 46,000 in the number of workers in the manufacturing and nonmanufacturing industries included in the survey, while weekly payrolls were $2,100,000 lower.

Production of lumber during the week ended July 24 stood at 80 per cent of the 1929 weekly average. The level of output was 21 per cent greater than new business booked and 11 per cent larger than shipments. Shipments were slightly below those in the preceding week, and new orders registered an upturn.

Fisher's Index Eases

Professor Fisher's index of wholesale commodity prices for the week ended August 7 stood at 91.8, as compared with 92.3 for both the week and two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended August 4 showed no changes in holdings of discounted bills, bills bought in the open market, and Government securities. Money in circulation increased $44,000,000, and the monetary gold stock rose $29,000,000.



A new "miniature" **catalog of packings**, covering the eleven most commonly used, has been issued by the mechanical goods division of United States Rubber Products, Inc.*

Illustrated handbook of materials that can be **molded** from Resinox powders, also concontaining use data, has been issued by the Resinox Corp.*

Fairbanks-Morse steam pumps are described in a new **bulletin** No. 6205. Deepwell oil lubricated turbine pumps are described in bulletin 6920. Bulletin 6920R describes water lubricated turbine pumps.*

A circular describing a new precision **drilling machine**, developed by the High Speed Hammer Co., Inc., has been issued.*

A **catalog** of the products of the Marvel Trailer Parts Co. has been published.*

New and more complete edition of the Haynes Stellite **booklet**, "Hard-facing with Haynes Stellite Products," has been issued. It is the fourth printing.*

Bulletin No. PA 607 has been issued by the Chevrolet Central Office describing the new ¾ and one ton trucks.*

Latest issue of "Nickel Steel Topics," that for August, published by the International Nickel Co., Inc., contains several **items of automotive interest.***

E. F. Houghton & Co. has reprinted **four articles** from its publication "Research." They are: "Are Plant Surveys Profitable?" "Of with the Old . . . On with the New!" "Modern V Packings," and "Bearing Metals and Lubrication."

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Consumer Tire Market Slow

Indicative of the sluggishness of the consumer tire market during the second quarter of 1937, in sharp contrast to record first quarter sales, total retail tire stocks in the United States declined only about 3 per cent from April 1 to July 1 despite comparatively light dealer ordering.

Total retail stocks in the hands of leading independent tire dealers, oil companies, tire manufacturers' company-owned retail stores and mass distributors including mail order houses, are placed at approximately 6,456,000 tire units as of July 1, compared with 6,622,000 on April 1 and average stocks of 5,754,000 for 1936, said the Department of Commerce in reporting the results of its July 1 tire stock census. The Government, effective with the July census, will make its tire stock reports quarterly instead of semi-annually as heretofore. Future reports will eliminate figures for dealers averaging less than 100 tires each as there is believed to be little, if any, fluctuation in such stocks which total around 1,000,000 units.

On July 1 larger independent dealers reported 2,161,000 casings on hand, compared with 2,465,000 April 1. Thirty-nine oil companies marketing tires through 41,505 outlets, listed inventories of 1,996,000 tires July 1 compared with 1,853,000 April 1. Six tire manufacturers with 1982 retail outlets and six mail-order houses and chain stores with 1731 outlets, reported 2,299,000 tires on hand July 1 against 2,304,000 April 1. The July 1 survey covered a total of 48,044 outlets.

First quarter consumer sales were approximately 8,000,000 against only 5,000,000 in the same period of 1936, but subnormal consumer buying in the second quarter when sales should have accelerated substantially, erased much of the first quarter gain, giving the industry only a net gain of about 10 per cent for the first half year.

Manufacturers' inventories which were less than 8,000,000 units a year ago, were in excess of 12,000,000 July 1, giving the industry a total stock position of more than 19,000,000 units or nearly a two-third's year supply. Consumer sales for the year are estimated at approximately 29,500,000 or 30,000,000.

Ask Ocean Car Freight Boost

Increases of from $2 to $4 per ton in ocean freight rates on cars, trucks and automotive parts have been requested by steamship conferences representing lines operating to all parts of the world at a series of meetings which have just been held with the export rate committee of the Automobile Manufacturers Association, J. S. Marvin, manager of the association's traffic department, disclosed.

Higher costs of supplies, wages, stevedoring, and in some cases, port charges, were cited by steamship executives as the basis for their proposals, according to Mr. Marvin. He indicated that the association's export rate committee would hold some further meetings to reach final adjustments with the several steamship conferences.

Members of the committee are: F. A. Allen, Hudson Motor Car Company; E. M. Grahn, General Motors Overseas Corporation; L. W. Krass, Chrysler Corporation, export division; Gilbert Smith, International Harvester Export Company.

Urges Highway Lighting

"At least 35 per cent of the night fatal accidents should be prevented by the provision of adequate highway lighting," according to a report on technological trends submitted to President Roosevelt by the National Resources Committee.

From figures submitted by the States of New Jersey, Oregon, New York, North Carolina, and Pennsylvania, it was observed that fatality experience was about the same for the summer months of May, June and July as it was for the winter months of November, December and January; with one important exception, however, that between the hours of 5 to 8 P. M., fatalities were 58 per cent higher in the winter months when it is dark than in the summer when it is light, and despite the fact that traffic volume is considerably less in the winter. The report estimates that a reduction of 47 per cent in night fatalities during the winter period should be expected if sufficient light were supplied.

. . . *slants*

NEED CARS —GET CARS—*Japanese merchants are "smuggling" cars into that country. The restrictions upon manufacture by Ford and General Motors branches have proven a particular burden because the demand for automobiles has risen steeply. The way it is done is to import the cars in small lots so that bills do not exceed 30,000 yen a month. Sums below that size may be settled without Government licenses to forward foreign exchange.*

NOW WHY SHOULD THAT BE?—*The magazine "Time Sales Financing," published by the National Association of Sales Finance Companies, has broken down by makes the list of cars seized from January through May by the Government for transportation of*

liquor on which taxes were unpaid. Ford led all the rest by a wide margin. There were 806 of them. Chevrolet was second with 276, Buick third with 89 and Plymouth fourth with 85. A total of 1821 cars were seized.

BUT THEY HAVE CARS—*Proof that the majority of automobile owners in Indiana are of less than $2,000 income average was furnished by Leland K. Fishback, secretary of the Indiana Petroleum Industries committee, in a report showing that 84.1 per cent of Indiana residents pay automotive taxes, while only 7.7 per cent pay federal income taxes. Of the 7.7 per cent paying federal income taxes, 50 per cent come within the $2,000 or less range. Single persons have an exemption of $1,000, married persons $2,500.*

Centrifugal Fusing Formed

Addition of a new company to the Lansing, Mich., industrial picture was revealed by Fred A. Wagner, vice-president in charge of manufacturing of the Centrifugal Fusing Company which has been granted a charter by the Corporation and Securities Commission and has taken over from the Campbell, Wyant and Cannon Foundry Company, of Muskegon, the lease on the newly completed fusing plant on McKinley street just north of the Motor Wheel Corporation's Plant No. 2. This plant was constructed by Motor Wheel and originally leased to the Muskegon company.

The new plant remains the property of Motor Wheel, but is now held under a long term lease by the Centrifugal Fusing Company, officers of which are Leon German, president; Carl Fors, vice-president; Wagner, vice-president in charge of manufacturing; and Byron L. Ballard, secretary and treasurer.

(Turn to page 233, please)

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

The Dreadnought Tire

Puncture-proof qualities are said to be secured by an articulated tread band, consisting of pieces of wood having concaved sides and pivots between them, thus permitting perfect freedom of yield with the give of the tire, but preventing sharp pointed projections from passing between the joints.

Resiliency is said to be just as perfect in the Dreadnought as in other first class tires. The articulated band is enveloped in a bed of rubber, which is coated with a suitable fabric, the arrangement being such that the individual members of the band have free movement, enabling the pneumatic cushion behind to yield to the same extent as it would without this band; but the manner of yielding is different, for, whereas the ordinary pneumatic tire absorbs at its point of contact an obstacle as a stone in the road, the Dreadnought yields at its tread over an extended surface, and also yields freely at its side walls (specially prepared for this purpose), thus giving more the effect of an easy and comfortable cushion.

From *The Horseless Age*, August, 1897.

Automotive Metal Markets

Copper and Tin Still Buoyant; Steel Mills Have Not Yet Received Large Scale Releases on Metal for New Cars

The price situation in the copper and tin markets again held the center of interest this week. While the domestic price for copper stood unchanged at 14 cents at the beginning of the week's activities, the rise in the export price to the equivalent of 14¾ cents was followed by a $5 per ton advance in custom smelters' bids for scrap and of $10 per ton in the prices of composition ingot makers. Moreover, it created the general impression that a fractional advance in the price of the red metal was "just around the corner," causing a good deal of semi-speculative covering.

Offsetting the pronouncements of economists that there was no substantial basis for any advance in copper prices, the American Bureau of Metal Statistics issued a statement that copper consumption by industries which absorbed about one-half of the 1936 total, aggregated 43,600 short tons in the second quarter of 1937 as against about 37,300 tons in the first quarter and 35,200 tons in the final quarter of 1936.

The tin market continued to hover around the 60-cent level, with spot Straits quoted at 60⅜ cents at the beginning of the week. The Navy Department is reported to have received a bid of as low as 58.70 cents for 200,000 lb. to be delivered at the Brooklyn Navy Yard within 45 days. Reports that drouth interfered with production in Malaya caused the Warden of Mines of that colony to issue a statement that lack of water had not affected production to any appreciable extent. Advances were largely a case of higher prices being in the air, as shown by a $10 per ton advance in the price of lead in the last ten days and of $5 a ton in the price of zinc.

Steel Marks Time

From several of the steel making districts come reports of a slightly higher inflow of specifications and shipping orders from automotive consumers, the material being intended for current model parts. But mills in other steel producing centers do not look for much in the way of automotive business until buying of steel for 1938 models really gets under way. Virtually in all descriptions of steel there was some buying for the initial, quasi-experimental production of 1938 models, but tonnage business has so far made its appearance only in sheets that had to be ordered sufficiently ahead to allow the necessary time required in the finishing processes and insure delivery when needed. Putting a broad interpretation on the week-to-week rate of operations of steel mills, which this week is at 84.6 per cent of capacity against 85.5 per cent last week, the steel industry may now be said to have fully recovered what ground it lost during the off-years that followed 1929. The best of steel years record ups and downs in the rate of week-to-week operations resulting from causes without bearing on the major trend.

Pig Iron—Automotive foundries are marking time with reference to their iron-buying programs. Melters have been virtually assured that there will be no change in prices over the remainder of the year and stocks in blast furnace yards are ample. More spirited interest in pig iron offerings, therefore, awaits increased demand for 1938 model castings and, later in the year, weather conditions that make more adequate stocks advisable.

Aluminum—Shipments of aluminum arriving from Europe continue of routine proportions. The banking house of J. P. Morgan & Co. received 500 bdls. of notched bars and 7,740 pigs this week from Genoa, presumably Swiss metal. The market for primary metal is unchanged.

Ford Builds at Vancouver

Contract for the construction of the Ford Motor Company of Canada, Ltd., assembly plant at Vancouver, B. C., has been awarded to Smith Bros. & Wilson at a price of $291,650 and construction will start immediately. The total cost of the project will be approximately $550,000. The steel contract was awarded to the Dominion Bridge Company, Ltd., for $96,000, and electrical and heating contracts have yet to be announced. Cost of assembly equipment will be added to construction total. It is planned to make the Vancouver assembly plant the most modern on the continent, fully air conditioned, with acoustical ceiling, stainless steel show windows and modern lighting, with windows motor-operated. Wallace R. Campbell, president of the Ford Motor Company of Canada, Ltd., Windsor, Ont., is expected in Vancouver in time for the turning of the first sod.

Company Earnings

Briggs Mfg. Co. reported net income for the June quarter of $3,453,771 or $1.75 a share, against $4,370,854 or $2.21 a share for the second quarter of last year.

Gemmer Mfg. Co. reported net income for the six months ended June 30 of $286,930 against $194,744 last year.

Goodyear Tire & Rubber Co. reported net income for the first half of the year of $8,068,352 after charges and adjustments including a charge of $1,500,000 for a special inventory reserve. This was equal to $3.18 per common share after allowing for preferred dividends. It compared with $3,598,683 or 62 cents a share for the first half of 1936 on the then capitalization. Net sales for the period were $116,475,700 against $90,908,684 last year.

Hayes Body Corp. reported for the June quarter net income of $7,908 against a net loss of $22,607 for the same period in 1936.

Hercules Motors Corp. reported for six months ended June 30 net income of $629,986 or $2.02 a share against $250,098 or 80 cents a share for the 1936 period.

Motor Wheel Corp. reported for the June quarter net income of $693,801 or 81 cents a share, against $643,724 or 76 cents a share in the second quarter of last year.

Pierce-Arrow to Add $1200 Car

Chanter Announces $11,000,000 Financing to Raise Funds For Financing Program in Medium Price Field

The Pierce-Arrow Motor Corp., Buffalo, N. Y., will again enter the medium price car field with an automobile which is expected will sell around $1,200. There are some indications that the company will follow this with the manufacture of a car to sell at about $1,000.

Financing arrangements have been made and about $11,000,000 for new equipment and working capital will be raised by the sale of stock to underwriters, according to A. J. Chanter, president of the company. It is understood that the Marine-Midland organization in Buffalo will have a major interest in the underwriting and that New York investment bankers will also be members of the group.

Mr. Chanter's statement said, in part: "During the depression the 'fine' car market shrank heavily for all manufacturers. Although returning prosperity has brought some degree of recovery in this field, the pronounced improvement in passenger car registrations has been in the medium priced field where fine performance and workmanship formerly associated only with cars in the several thousand dollar class have been coupled with prices within the reach of a greatly increased number of people.

The percentage of passenger car registrations in the $700 to $1,400 field was only 11 per cent of total registrations in 1933. This figure increased to 31 per cent in 1936 and to 34.9 per cent in the first five months of 1937.

The addition of a medium priced Pierce-Arrow car, for which present distributors have indicated a tremendous demand, to the higher priced Pierce-Arrow and the trailer lines will make possible very profitable operation of the company's plants.

Car Prices Raised

(Continued from page 206)

extra. On all models of the "60" series, the increases were in the higher range, making that line sell at $730.04 to $905.80.

Excepting for the "85" coupe which was raised $21.21, increases ran more and up to $32.96. The range is now $795.81 to $940.95. In the "85" de luxe line the increases were nearly $33 per model and the range is now $869.01 to $1,005.78.

The "60" coupe was unchanged at $730.04 and several de luxe small-production models were unchanged.

ASME To Test Indicator

A demonstration of the Zeiss Ikon Piezoelectric indicator will be made at the forthcoming oil and gas power meeting to be held at State College, Pa., Aug. 18-21. The meeting will be under the joint auspices of the oil and gas power division and the Central Pennsylvania section of the American Society of Mechanical Engineers and the School of Engineering, The Pennsylvania State College. The indicator is said to be suited for inertialess registering of very fast running pressure or force changes.

Among the features of the meeting will be progress reports by a number of major manufacturers and a number of papers on Diesel engine development.

Hayes Body Sales Change

Changes in the character of the business done by the Hayes Body Corp. have resulted in large measure from the suspension of operations by certain of its automotive customers. The company therefore went more extensively into the manufacture of automobile stampings, contrasted with automobile bodies, refrigerator stampings and tools, dies, jigs and fixtures.

The automobile customers it lost, or practically lost, were Marmon Motor Car Co., Continental Automobile Co. De Vaux Hall Motor Corp., American Austin Car Co., Reo Motor Car Corp. and Hupp Motor Car Corp.

In a listing application to the New York Stock Exchange, covering a proposed additional listing of common stock for bond conversions, the company supplied a schedule of the percentages of its business done with major customers for the year ended Sept. 30, 1936, and a schedule of anticipated percentages for the current fiscal year.

The schedules are as follows:

	Per cent of total in fiscal year ending Sept. 30, 1936	1937
Graham-Paige Motor Corp..	34	22
Reo Motor Car Co.....	38	10
Nash Kelvinator Corp.....	4	3
Norge Division Borg Warner Corp.	2	4
American Austin Car Co....	..	2
Pontiac Motor Car Corp....	3	3
Hupp Motor Car Corp.....	15	13
Buick Motor Car Corp.....	..	5
House and commercial display trailers*	..	35
Sundry	4	3

*New line.

Chrysler Buys 13 Acres

Chrysler Corp. has confirmed the purchase of 13 acres of land adjoining its main plant in Highland Park, Mich. The property had been used for a golf course, Although acquisition of this extensive tract suggests important expansion may be contemplated, the corporation declined to comment further on its plans.

BERNARD KOETHER has resigned as director of customer relations of General Motors Corp. after 36 years of service in the automotive industry. Mr. Koether came into the automotive business in 1901 as an employe of Hyatt Roller Bearing Co. An announcement by the corporation stated that Mr. Koether resigned to devote more time to his personal interests and leaves with the best wishes of the corporation.

T. E. WISNER, service merchandising manager, Chrysler Motors Service Division, is taking an extended trip to confer with Dodge-Plymouth, DeSoto-Plymouth, and Chrysler-Plymouth dealers from Kansas City to the west coast.

G. HALL ROOSEVELT has joined the executive staff of Commercial Investment Trust Incorporated, a subsidiary of Commercial Investment Trust Corporation.

ROBERT BRUCE has been appointed organization director and **MORTON J. CROOKS** director of distribution for Hupp Motor Car Corporation, it was announced by W. A. MacDonald, vice-president and director of sales.

F. L. EDMAN, formerly connected with the sales department of Reo Motor Car Co., and more recently advertising manager of the Covered Wagon Co., coach trailer manufacturers, has severed his present connection. His plans for the future have not been announced.

D. KIRKE MOORE, long associated with the automobile parts industry, has joined the Edward G. Budd Manufacturing Company and will handle special sales work. He will be attached to the Detroit Division with headquarters at Detroit.

Plymouth Plant Reopens

Some 20,000 automobile workers in three plants returned to their jobs Aug. 9 after the Plymouth local of the United Automobile Workers voted to accept an agreement reached late Saturday between union and Chrysler officials. The pact, ratified by an estimated 2000 UAW members Sunday afternoon, permitted resumption of operations by the Plymouth plant, closed Aug. 14, when a riot took place between members of the UAW and the Independent Association of Chrysler Employes. The resultant shut-down of the Plymouth plant was followed by closing of departments at the Briggs Mfg. Co. involving 7000 employes and departments in the Dodge plant engaged on Plymouth work and involving over 2000 employes.

Terms of the agreement were not disclosed but the main issue in the controversy was the demand of the union for the return to work of four of its members discharged for fighting. The management agreed to hear the cases of these men and hearings were begun Aug. 10 before Herman L. Weckler, vice-president in charge of industrial relations for the Chrysler Corp. The UAW men were represented by Larry Davidow, a union attorney, and Leo Lamotte, president of the Plymouth local.

Striking workers of the American Broach & Machine Co., Ann Arbor, Mich., returned to work Aug. 9 after an agreement had been arranged for starting negotiations.

Althogh president Homer Martin and other high UAW officials have gone to Milwaukee for the executive board's meeting and to prepare for the annual convention of the union starting Aug. 23, conferences are continuing between General Motors officials and union representatives on demands of the corporation for guarantees against wild-cat strikes, conditional to negotiating a new contract.

In these preliminary conferences, the union is now represented by its new economist, W. J. Lauck and three members of the permanent GM bargaining committee of the UAW, elected by GM locals. Because of the absence from the city of leading union executives it is considered doubtful if any decision will be reached before the Milwaukee convention is over. At least, discussion of the union's demands for revision of the contract in all probability will be postponed until that time.

Meanwhile the present agreement remains in force. Many have held the mistaken impression that its expiration date was August 11, but neither party has asked to terminate it.

100,000 More 1937's

(Continued from page 203)

Studebaker, Cadillac-LaSalle and Oldsmobile. Buick goes down this weekend. —H. E. G.

Cadillac-LaSalle deliveries to customers in July for the sixth consecutive month topped the comparative monthly highs of the company, Sales Manager D. E. Ahrens announced. "The previous all-time peak for July was set in 1929," said Mr. Ahrens, "when 2571 cars were delivered at retail. This year in July dealers reported 3840 cars, registering an increase of 49.3 per cent over the former record.

Sales of Studebaker passenger cars and trucks in the first seven months of 1937 were 25 per cent ahead of 1936, according to President Paul G. Hoffman. For July, Mr. Hoffman reported the sale of 4387 units compared with 1436 in July, 1936, bringing sales for the year to date to 61,028 compared with 49,020 a year ago.

UAW March Uneventful

(Continued from page 203)

now in session in Milwaukee demanded their immediate return, they boarded another plane without staying for the Ford demonstration. Members of the Martin faction charged Hall and Reuther with coming to Detroit to play politics.

Coincident with the march on the Ford plant, the UAW ran quarter page advertisements in the local papers soliciting membership in the Ford local. "Thousands of Ford workers have already joined," the advertisement stated. "Come along with us now and we'll get a Ford agreement for higher wages, shorter hours, seniority (security) on the job, union protection for yourself, reduction of speed-up and an end to the Ford service system." The "cut-out" application blank advised prospects that the regular initiation fee had been eliminated and requested enclosure of $1 for first month's dues. The blank also contained the statement: "I understand that my name will be kept confidential and that all correspondence with me will be in plain envelopes."

Manning's New Car Plans Awaited

Directors to Meet Aug. 20; Reorganization of Cord Corp. Expected as Former Cord Aide Takes Over Control

(Continued from page 203)

In addition to Mr. Manning, who will become president and operating executive, the buyers include Schroder, Rockefeller & Co., Inc., and Emanuel & Co.

Mr. Cord has already ended his connection with the company. It has been reported that he will retire from active business. He is 43.

To the Cord Corp. board of directors have been added representatives of the purchasing group. The new board will consist of Victor Emanuel, partner in Emanuel & Co., who will be its chairman, Gerald E. Donovan, vice-president and a director of Schroder, Rockefeller & Co., Inc., Tom M. Girdler, chairman of the Republic Steel Corp., C. C. Darling, partner in Miller & George, brokers of Providence, who have a large interest in the Aviation Corp., Henry Lockhart, Jr., a director of Shell Union Oil Co. and of Commercial Solvents Corp., R. S. Pruitt, long counsel to Cord Corp., and Mr. Manning. Resignations were those of Mr. Cord, H. T. Ames, L. K. Grant and P. P. Willis.

Answering numerous inquiries on the matter, Mr. Manning on Aug. 10 said that no resale was planned and that the total interest of the purchasing group is only about 30 per cent. He said no new policies would be discussed until the directors met on Aug. 20. It has been reported that with a change of name, the character of the company's operations would be somewhat altered.

Said Mr. Manning, "Cord Corp. itself does not actually control most of the companies in which it holds a substantial interest. The corporation holds approximately a 29 per cent stock interest in Auburn Automobile Company, a 30 per cent interest in Aviation Corporation, a 30 per cent interest in Checker Cab Manufacturing Company, and an interest of approximately 26½ per cent in the founders shares of New York Shipbuilding Company.

"Cord Corporation controls Columbia Axle Company, which manufactures automobile axles and other automotive parts, and owns 37½ per cent of the common and 75 per cent of the preferred stock of Lycoming Manufacturing Company, which makes a diversified line of manufactured products."

Two years after his graduation from Sheffield Scientific School, Yale, Lucius B. Manning joined the Griffith Motor Car Co., Tacoma, Wash., where he was born on Aug. 18, 1894. He joined the Army Air Service in 1917, became an aviator and was commissioned Second Lieutenant. After the Armistice he was in the securities investment business in Seattle, and joined the firm of Seaverns & Co., Chicago, in 1922. During his connection with this investment firm he became acquainted with E. L. Cord, and in 1925 formed the firm of Manning & Co., with offices in Chicago. The same year he was elected executive vice-president of Cord Corp., the holding company for Mr. Cord's expanding interests. Manning & Co., was later dissolved.

He interested Mr. Cord in aviation. In 1933 Mr. Manning became president of Stinson Aircraft Corp., and was elected chairman of the board of American Airways, Inc., the same year. Shortly after this he became publicly identified with the various Cord companies, as president of Cord Corp., and chairman of the board of the New York Shipbuilding Corp. By 1934 he had become a member of the executive committee of Checker Cab Mfg. Co., president of Aviation Corp., a director of Columbia Axle Co., Duesenberg, Inc., Allis-Chalmers Mfg. Co., Limousine Body Co., L.G.S. Devices Corp. (freewheeling), The Properties Co., Pan-American Airways Corp., and a number of subsidiary companies. Mr. Manning was made chairman of the Aviation Corp. board in 1936, relinquishing his post as president of the Cord Corp.

The Auburn Automobile Co. had a meteoric career, selling thousands of cars, and making a great deal of money after Mr. Cord became general manager in 1924. Mr. Cord started as a Chicago automobile salesman. Its stock was a spectacular feature on the New York Stock Exchange in 1929. Of recent years, the company has reported a series of deficits and is not now manufacturing Auburn automobiles although Cord front drive cars are being made.

The Securities and Exchange Commission announced Aug. 6 that it had filed a bill against E. L. Cord and Morris Markin, president of the Checker Cab Mfg. Co., in the United States District Court at Chicago to enjoin them permanently from further violation of the anti-manipulative sections of the Securities Exchange Act of 1934. The defendants consented to the entry of a decree granting all the relief sought by the commission, but denied the charges.

The bill, which was based on extended investigation by the commission, described alleged manipulative activities of Cord and Markin in the securities of Checker Cab Manufacturing Corporation, of Chicago, Ill., Parmelee Transportation Company, of New York, and Chicago Yellow Cab Company, Inc., of Chicago, and Cord in stock of Auburn Automobile Company, of Auburn, Ind. These stocks are listed on the New York Stock Exchange, and Chicago Yellow in addition is listed on the Chicago Stock Exchange.

Books

of automotive interest

Automobilens Historia (*History of the Automobile*), by Captain John Nerén. Published by Motor-Byräns Förlag, Stockholm.

For twenty-two years the author of Automobilens Historia painstakingly followed the trail of material for what he terms to be "really and truly my life's work." He spent thousands of hours (11,000 by official report) compiling the mass of data obtained from poking around dusty museums, interviewing top men in the industry such as Louis Bonneville, Charles Jarrott and Gaetano Besna, and in culling pertinent technical literature in English, French, German, and his native Swedish.

Captain Nerén has divided his subject matter into seven main sections: 1. The Era of the Steam Car; 2. Internal Combustion Engines and the First Petrol Cars; 3. Manufacture of the Motor Car Becomes a Great Industry; 4. Sweden and the Motor Car; 5. Taxis, Trucks and Motor Omnibuses; 6. Development and Improvement of the Motor Car; 7. The Motor Car after the Great War. Each of these sections is subdivided into chapters; the section dealing with development and improvement of the automobile takes up 300 pages and includes almost 500 illustrations.

Pictorial material is arranged so that it is possible to trace the course of development without knowledge of Swedish. A complete index with approximately 1500 separate headings adds to the value of the book as a reference volume.

Captain Nerén's "life work" seems to be a very worthwhile addition to the four other existing historical works on the automobile: Historie de l'Automobile, 1906; Motor Cars and Their Story, 1912; The World on Wheels, 1928; and Z Dejin Automobilu, 1931.

"The Motor Industry of Great Britain." Compiled by the statistical department of The Society of Motor Manufacturers & Traders, Ltd., London.

This is the twelfth edition of a reference book. It is divided into a number of sections covering roads, taxation, legislation, production, imports, registrations, exports, world registrations, rubber and tires, marine motor, craft, fuel and oil and an appendix on the organization of the industry.

A new book, "Facing the Tax Problem," has been published by the Twentieth Century Fund, Inc.

Equipments Ease in June

Forty-eight original equipment plants paid their employees $9,375,000 in the four weeks ended June 26, against $10,700,000 in the preceding four weeks, and against $7,267,000 in the June period of 1936, according to the Automotive Parts and Equipment Manufacturers, Inc. Average weekly earnings fell slightly from the two preceding periods due to shorter hours and were $28.09 against $31.36 in the preceding period and $27.07 a year earlier.

Letters

to AUTOMOTIVE INDUSTRIES

BIAS

I am enclosing my check for another year's subscription to AUTOMOTIVE INDUSTRIES, to be sent to the address now on your books. All you say about the value and technical information given by the magazine is true, and I find it extremely useful in my work as a consultant.

The magazine has one serious drawback—its politically reactionary and anti-labor bias. This I find distressing, not to say disgusting. I realize that strikes, and the aim of labor to better itself in general, are disruptive of the technical organization which produces automobiles, even though the purchasing power of labor is the basis on which the industry depends for the sale of its product. Irritation on account of this disruptive influence is natural enough.

But there is another source of disruption of the technical process which is never mentioned in your pages—the constant interference and jockeying for position which is the function of business management, which hampers technical procedure at every turn, thwarts it, and stultifies the energies of engineers. The fact that automobiles are merchandise reaches down into the design of every part of them and modifies it. Do engineers, or does AUTOMOTIVE INDUSTRIES in particular, have to be quite so faithful to its bread? Can't a hint creep in once in a while of what engineers could do if they had a free hand? Of what they would praise and condemn in the final product?

LAURENCE E. CROOKS,
Reno, Nev.

E. F. Rauss

Edwin F. Rauss, for 30 years identified with the automobile industry and at the time of his death assistant to the superintendent of the Cadillac Motor Co., died at the age of 49.

Calendar of Coming Events

SHOWS

Poland, Automobile Salon (Foire Orientale), Lwow .....Sept. 1-15
Yugoslavia, Automobile Section, Autumn Fair, Ljubljana .....Sept. 1-12
Yugoslavia, Automobile Section, Commercial Fair, Belgrade.....Sept. 11-21
France, 31st International Automobile Salon, Paris .....Oct. 7-17
Great Britain, 31st International Automobile Exposition, London...Oct. 14-23
Czechoslovakian Automobile Show, Prague .....Oct. 16-24
National Automobile Show, New York, Oct. 27-Nov. 3
Toledo, O., Automobile Show.Oct. 27-Nov. 3
Italy, 10th International Automobile Salon, Milan .....Oct. 28-Nov. 8
Boston, Mass., Automobile Show, Oct. 30-Nov. 6
Los Angeles, Cal., Automobile Show, Oct. 30-Nov. 7
San Francisco, Automobile Show, Oct. 30-Nov. 7
Cincinnati Automobile Show.Oct. 31-Nov. 6
Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London...Nov. 4-13
Chicago Automobile Show .....Nov. 6-13
Akron Automobile Show .....Nov. 6-12
Omaha Automobile Show.....Nov. 6-11
Brooklyn Automobile Show.....Nov. 6-13
Columbus Automobile Show .....Nov. 6-12
Detroit Automobile Show.....Nov. 6-13
Motor Truck Show, 4th Annual, Newark, N. J. .....Nov. 6-12
Newark, N. J., Truck Show.....Nov. 6-12
Buffalo, N. Y., Automobile Show..Nov. 6-13
Indianapolis, Automobile Show....Nov. 6-13
Newark N. J., Automobile Show..Nov. 6-13
Philadelphia Automobile Show....Nov. 6-13
Pittsburgh, Pa., Automobile Show.Nov. 6-13

SHOW BUSINESS

Manager of the National Automobile Show in New York is Alfred Reeves, 366 Madison Ave., N. Y. C. Inquiries concerning all matters connected with the national show should be addressed to him. AUTOMOTIVE INDUSTRIES will be pleased to furnish names and addresses of local show managers on request.

Toronto, Ont., Automobile Show..Nov. 6-13
Great Britain, 36th Scottish International Automobile Exposition, Glasgow .....Nov. 12-20
Baltimore, Md., Automobile Show, Nov. 13-20
Cleveland, Ohio, Automobile Show, Nov. 13-20
Jersey City, N. J., Automobile Show, Nov. 15-20
Milwaukee, Wis., Automobile Show, Nov. 17-24
Springfield, Mass., Automobile Show, Nov. 14-20
St. Louis, Mo., Automobile Show.Nov. 14-21
Portland, Ore., Automobile Show.Nov. 14-21
Denver, Colo., Automobile Show, Nov. 15-20
Montreal, Que., Automobile Show, Nov. 20-27
Kansas City, Mo., Automobile Show, Nov. 27-Dec. 4
A.S.L. Show, Navy Pier, Chicago, Dec. 6-Dec. 11

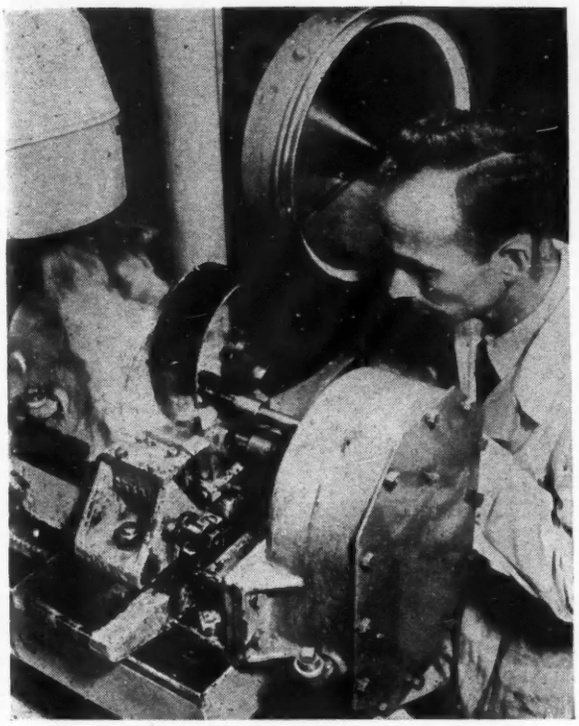
CONTESTS

National and International Soap Box Derby Finals, Akron, Ohio.....Aug. 15
National Outboard Championship Regattas, Richmond, Va. .....Sept. 18-19

CONVENTIONS AND MEETINGS

U.A.W. Annual Convention, Milwaukee, Aug. 23
American Chemical Society, Rochester, N. Y. .....Sept. 6-10
International Congress on Carbohydrate Carburants, Rome .....Sept. 10-12
National Trailer Show, New York, Sept. 10-15
S.A.E. Section Regional Tractor Meeting, Akron, Ohio.....Sept. 15-17
American Transit Association, 56th Annual Convention, White Sulphur Springs, W. Va. .....Sept. 19-23
S.A.E. Section Regional Transportation Meeting, Chicago .....Sept. 29-Oct. 1
American Foundrymen's Association Midyear Meeting, Columbus, Ohio, Sept. 30-Oct. 1
S.A.E. Fuels and Lubricants Regional Meeting, Tulsa, Okla. ....Sept. 30-Oct. 1
S.A.E. National Aircraft Production Meeting, Los Angeles, Calif.....Oct. 7-9
American Foundrymen's Association, Regional Conference, Rolla, Mo., Oct. 8-9
National Battery Manufacturers Asso., Chicago .....Oct. 10-12
National Metal Congress, Atlantic City, Oct. 18-22
S.A.E. Annual Dinner, Commodore Hotel, New York .....Oct. 28
American Petroleum Institute, 18th Annual Meeting, Stevens Hotel, Chicago .....Nov. 8-12
S.A.E. National Production Meeting, Flint, Mich. .....Dec. 8-10

Production Lines



Special lubricants tested by unique machine—special lubricants, such as those used in the "hypoid" rear axle gears of the new Chevrolet, have been undergoing development on this intricate machine by engineers of the General Motor Research laboratories. Two steel bearing races, mounted on separate spindles, are brought together under a constantly increasing pressure. These hardened steel surfaces are separated by only a thin film of the lubricant being tested. The spindles upon which they are mounted are rotated at fixed but different speeds so that there is slippage and friction between the races. As the pressure becomes greater and greater the lubricant is literally "squeezed to death" and finally breaks down under the tremendous pressure applied.

Better Work

When the die-cast radiator grilles came into the picture they did more than just create a better medium for expressing advanced styling. The biggest contribution came from the fact that the die casters found it necessary to install the big, massive die casting machines that are now a part of the equipment of important producers. These machines are so massive and powerful that there is no longer a danger of producing large castings with visible or hidden flaws. Although the big machines are indispensable for grille castings, they fit into the need for producing perfectly fitting and sound die castings of all sizes, particularly castings used for structural elements.

Modernized Plants

Take any cross-section of automotive plants this season and you will find an unusual activity in plant modernization. New production machinery is coming in everywhere. Perhaps the biggest activity is found in conveyorization, with conveyor lines of every type going into even the smaller establishments. Foundries are coming into their own this season along with the general drive for modernization. This is being reflected in a wider use of automatic and semi-automatic molding machines, core blowers, and molding conveyors.

Science Helps

Some of the most precise of the instruments used in pure science have become valuable tools of the metallurgist and the research laboratory. X-Rays now are commonly used for the examination of metals, exploration for porosity in castings, etc. The next step along this line of investigation is the use of Gamma-rays (radium) for exploring larger masses with penetration above six inches of steel. This has been done for some time in certain industries but will be novel in the run of laboratories of the automotive industry. Another important tool is the large and medium-sized spectroscope which is invaluable in the examination of metals. Not only is it more rapid than any chemical analysis but it is the only way in which minute traces of impurities may be measured and isolated.

Flexible Control

An old line producer of flexible shaft drives and controls has found it quite feasible to expand the applications of the familiar flexible cable to many unusual places on the car. In fact, they have twelve specific places that will interest the engineer. Here they are—radio controls, combined choke and needle valve control, automatic carburetor control, crankcase drain, windshield wiper drive, speedometer drive, retractable headlights, spot light control, clock setting, trip mileage setting, antenna adjustment, remote gear shifting control. We give you this list as a starting point for many fruitful ideas.

On Transmissions

Seemingly there is no end of development in transmissions for the coming year. There should be two or more cars with the automatic transmission as typified by the one announced by Olds. Then there are two or three independents with remote control shifting of extremely novel nature. Under the surface, there is a probability that others also may incorporate some form of remote control, following the trend.

Accident Causes

Industrial Standardization notes the development of a new code which will record accident causes as a means of providing essential information for the prevention of accidents. Principal headings in the code comprise—the agency, meaning machine, vehicle, etc.; the agency part, meaning the particular part or element creating the hazard; kind of accident, unsafe act or violation of safety rule; personal cause for unsafe action; proximate mechanical cause—relating to absence of safety provisions, etc. Proper use of the new code should provide a better analysis and understanding of accident causes and their prevention. —J. G.

It's *Time* for Industry to Talk to INDUSTRY

By Mabel Potter Hanford*

FROM mine—to mill—to factory. How rarely is the life of the greatest industrial country the world has ever known been conceived in this most logical movement of goods. With all the future of the United States committed to industrial activity, business in general stresses but one side of the picture, and blindly focuses most of its advertising and sales effort on the movement of goods from dealer to consumer.

Yet—it is the *movement between industries* which makes up the pulsing life of this country today. The exchange of money between mill and factory, between mine and mill, far outdistances any amount poured out by consumer to dealer. It is only necessary to consider what happens when something interferes with some one source of supplies, to see how all movement of goods may be stopped or curtailed, and industrial activity inescapably affected. Industry *subsists* not on what the general consumer buys so much as upon what industry itself purchases.

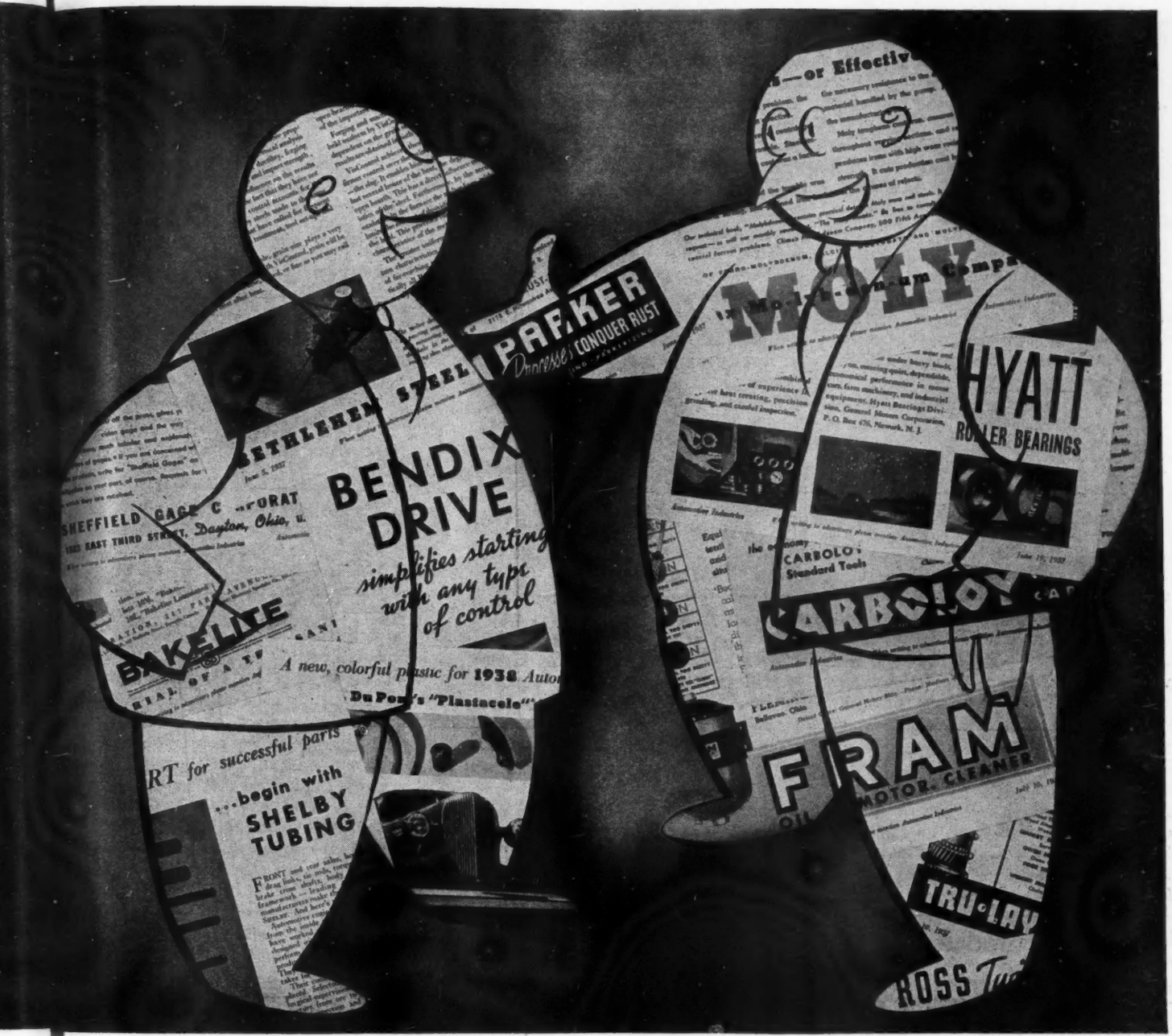
To be sure, there must be the ultimate consumer for the completely fabricated product. In the automotive industry, for example, the chances are that the product is visioned by all who furnish any part or equipment thereof, as a complete automobile with each separate item of equipment and accessory in its proper place. Even the industry which produces the basic material, selling to *his* customer—the buyer in the shop who must purchase and fabricate that material into the beginnings of a car—probably in his mind's eye spotlights the man-on-the-street who shall be the ultimate buyer of the car built of that material. And the man in the shop who specifies the steel to make the body or selects the spark-plug to set the motor throbbing, or designs the wheel to roll it over the roads, or contracts for the tires to cushion those self-same wheels—he, too, sees the ultimate product first, the method and materials to produce that product second.

In the enthusiasm for the completed product, producers of those things which go into its making have imagined that the buyer of a car is ready and anxious to talk expertly about hydraulic brakes, steel bodies, brake-linings, ball-bearings, ventilation, upholstery, etc.—forgetting that to the average car buyer these matters are mainly the window-dressing of the

*Mrs. Hanford is business-paper space buyer on the staff of Batten, Barton, Durstine & Osborn, advertising agency, New York. In 15 years with the agency, she has become known in the advertising business as an authority on business papers in their relation to industry and trade.

Leading business papers with audited circulations, established ethics, and adequate organizations, maintain their own trade association—The Associated Business Papers, Inc. In the past three years the volume of business placed by Mrs. Hanford with member-papers of this organization has exceeded that placed by any other space-buyer. In 1934 B. B. D. & O. placed 1550 pages; in 1935, 1998 pages; in 1936, 3514 pages in A.B.P. publications.

The exchange of money between mill and factory, between mine and mill, far outdistances any amount poured out by consumer to dealer. Industry SUBSISTS not on what the general consumer buys so much as upon what industry itself purchases.



car manufacturer. Any dealer worth his salt will use them as such, and if the customer recognizes the product or the force of the argument, all the better. After all, every salesman likes the buyers to show a spark of awareness and interest in the subjects which comprise points one, two and three of his selling argument.

Naturally, the automotive industry would not exist if there were not this ultimate consumer to purchase the completed product. On the other hand it is a fact that that ultimate consumer would be obliged to accept whatever is made by the manufacturer and offered by him through his dealer. It is even conceivable that he would purchase a universally styled and equipped car if that were all that the manufacturer had to offer. The difference in cars which are presented for his inspection and his purse lies entirely in the difference in parts and equipment and the manner of putting them all together to make a car.

But the selling of those materials and parts and equipment must be done to the manufacturer FIRST. Unless the car manufacturer *buys* there just isn't any car. His draftsmen may draw a pretty picture of the finished product, but the shop has to find the materials and the parts, and the machinery to fabricate and assemble before there can even be a car. In other words, the car manufacturer like a vast majority of other manufacturers of products sold to the general consumer, becomes a center-spot around which revolves a great number of other manufacturers to whom he, himself, is the ultimate consumer. He has only to show a speci-

fication sheet of the visioned product to set the wheels of a hundred and one other industries spinning to turn that specification into something to put in a dealer's salon or on the retailer's shelves.

Now, nothing in this article should be construed as suggesting that consumer merchandising and advertising be curtailed. If anything Thomas G. MacGowan's excellent article published in AUTOMOTIVE INDUSTRIES last fall,* entitled "How Much Automobile Advertising Sticks," indicates that although there may be a general impression that automobile and accessories manufacturers have been overly large advertisers to consumers in the past, the story is as yet but half told and the car purchaser still sadly in need of further education regarding what goes into the car he buys.

We know, too, that car purchasers are asking questions which they would not have dreamed of asking ten or fifteen years ago. Advertising has made them mighty conscious of many items which make a car go but I sincerely doubt if so much as 5 per cent of the buyers of a car would refuse to accept the product if it were not equipped with some one item on which they thought themselves sold by consumer advertising. Naturally the consumer advertising has played a strong part in leading the car buyer into a certain dealer's shop. But it won't keep him there or ultimately sell him, as every dealer can tell you. It is the dealer in the end who sells what the manufacturer has produced and placed on his floor, and he sells the customer, not the separate parts and equipment of a car, but the complete product. And that complete car is a compilation of products *first sold to the car manufacturer.*

Take it any way you will—it comes inevitably back to that all important, inescapable movement of goods from mine to mill, from mill to factory—and between factories, between types of industries. The mine supplying the foundry, the obscure and unknown chemist producing a new material, the process of fabrication within fabrication, the loading and unloading of cars and trucks moving restlessly from industry to industry—this is the marketing picture of industrial life in America.

The amazing thing about it is that industry has been so blind to its main market. Back of every manufacturer lies the vision of some man or group of men who, while seeing the finished product that the general consumer will eventually purchase, sees FIRST the *process of manufacture* of that product. The inspiration of fabricators comes from those who furnish the material for fabrication. A manufacturer may dream of what he could do with a material like stainless steel, for instance, but he is helpless until the steel mill has a like vision and with it the ability to make the dream come true. The inspiration for a better made product may exist in the machine shop, but it is the foundry or the industry which makes the machinery, or the control instruments or the refractory or the fire brick or the abrasive—or a hundred and one products which satisfies that inspiration.

New products, new models come to pass because far down the line somewhere something has been done to the stuff brought up from the mine, because somebody has taken a combination of chemicals and produced that which has never been fabricated before, because someone in the machine shop has been sold on a new method of handling production to achieve a different but highly interesting and profitable result.

It has seemed to me that many manufacturers have seen this advertising and selling job wrong way to. They have seen it as working from customer —to dealer—to manufacturer. It is like turning the hands of the clock backward and orderly, logical movement doesn't work that way. It is as if in the complexity of industrial activity we have tried to make the whole merchandising and advertising effort complicated. Just as the movement of goods is from industry to industry long before it is from industry to dealer and dealer to consumer, so there should be a recognition of industry's primary market—which is industry itself. When we try to make it complex we lose the whole point of directed advertising to a known market.

Industrial activity does not depend so much upon what the consumer buys as upon what industry itself buys. And the first selling job to be done is the selling which industry shall do to industry. Actually, of course, industry likes to think of itself as progressive, but except in rare instances, industry isn't out looking for goods to buy—it *is waiting to be sold* those goods. Whether it realizes it or not, industry is a bit of a snob. It thinks it has everything. While mouthing words about progress, it resists change with all its might. Industry is very human for it has to be *sold* and repeatedly sold, progress and change. It takes the line of least resistance as long as it can and as long as competition lies quiet. But it is, when it is aroused, a giant—and it is amazing how it can be aroused by a new idea, a new product, a new material when someone is smart enough to tell them about it. And often the telling of that story is like the Mother Goose rhyme told to a little child. Ask the child to repeat it and in all probability it is babbled readily and faithfully, but that will not prevent the request to be told the tale again.

Industry, giant that it is, is very like that little child. It thinks it knows the story. It might even be able to repeat the story, but the telling of it over and over is necessary—until the day comes when suddenly the known becomes the most important thing in the world, and the material, the equipment, the process of manufacture, talked about for months in advertisements sometimes but half read in his business paper, is the key to a new model, a more profitable operation in the shop, a better method of transportation, a sounder financing system.

It takes a lot of persistent, patient hammering away at facts, retelling of the story, and it is not surprising if the story grows stale to the teller, but that story is consistently new to the listener and the reader, and it is after he has learned to babble its facts without too much prompting that it suddenly becomes an order.

The movement from industry to industry! Isn't it time industry itself recognized its first and primary market? The activity is between industries, and the way to sell industry to itself is

*Issues of Nov. 7, 1936, page 614; Nov. 28, page 746; Dec. 12, page 816 and Dec. 19, page 858.

The difference in cars presented for consumers' inspection lies entirely in the difference in parts and equipment and the manner of putting them all together to make a car. But the selling of those materials and parts and equipment must be done to the manufacturer FIRST.

It is amazing that industry has been so blind to its main market. Back of every manufacturer lies the vision of some man or group who, while seeing the finished product, sees FIRST the process of manufacture. The inspiration of fabricators comes from those who furnish the material. His visions are only visions until someone develops the materials and means of supply and lets him know about it.

through industry's own medium—the business press. Here it is possible to talk, not alone to the executive or buyer upon whom the salesmen calls to obtain the order, but to do a completely educational job with all those who have a voice in the production of a product, from the foreman in the foundry who must produce the machinery to fabricate, to the chairman of the board whose calculating eye sees the resultant product and rates it against the cost of production.

Industry itself wants to know, and the job industry has is to see that the telling is sufficiently spread so that all who have anything at all to do with the making of the final product may know. It is conceivable that not even the president of the company is more personally concerned in the product that the consumer buys than the mechanic who helped shape that product. This is the very essence of industrial life in America today—that pride in what one has helped to make or accomplish is evidenced again and again by a sort of fierce loyalty to that product by all who have had to do with the making of it.

Let there be no misunderstanding—the advent of a new material, the change in a molding, the acquisition of a particular type of equipment, isn't a matter of one man's decision—it is something that concerns many departments, many men and executives who have little direct say about such a change but a great deal of unseen and untold influence just the same.

Industry has done but a mediocre job of telling industry about itself. Isn't it time that industry set seriously about selling itself "down the line"?

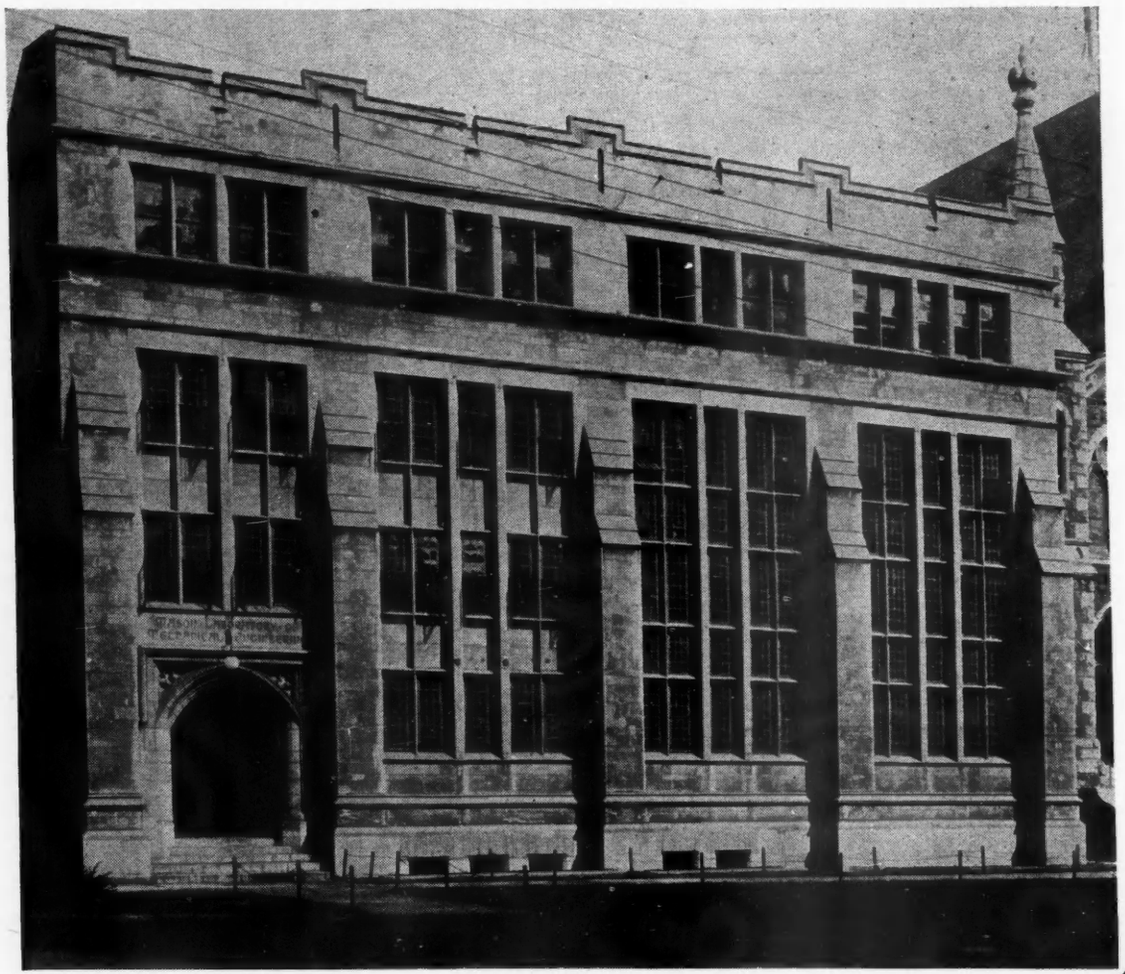
Developments in Phenol Process For the Treatment of Lubricants

DEVELOPMENTS which have increased the flexibility of the phenol process for the treatment of lubricating oils were discussed in a paper contributed by R. K. Stratford to the Chemical Engineering Congress of the World Power Conference held at London. Mr. Stratford stated that the use of solvents for the treatment of lubricating oils had increased during the past few years and there had been a search for new solvents that could be handled in large quantities. The solvents in use today included furfural, ortho-dichlorethyl ether, SO_2-benzol, nitrobenzene, phenol and propane-cresol.

There were two types of solvent in use for treating lubricating oils, viz., single solvents and solvent mixtures. The single solvents usually removed the unstable constituents or those of low viscosity index, while the double solvents removed the high molecular weight and asphaltic constituents as well as the unstable low viscosity index materials. The phenol process consisted, in agitating lubricating oil with anhydrous liquid phenol, usually in the proportion of one to two volumes of phenol per one volume of oil and at temperatures between 120 deg. F. and 200 deg. F. The phenol dissolved the unstable, acidic and so-called aromatic and naphthenic materials from the more paraffinic portions of the oil. By reason of the difference in their specific gravity the two layers separated out rapidly on mixing. The treated oil containing 10 per cent to 15 per cent of phenol rose to the top, and the phenolic layer with 20 per cent to 35 per cent of phenol sank to the bottom; after treatment the phenol was removed from the oil and recovered by distillation.

The improvements in the present operation of the process consisted in (1) more simple and efficient recovery of the phenol from phenolic water, by scrubbing the vapors from phenolic water with a small proportion of the hot oil going to the phenol plant. (2) The elimination of emulsification difficulties which had, on occasion, been serious enough to prevent the use of the process. This was achieved by observing that the emulsification was due to the entrainment of asphaltic material with the distillate during the preliminary distillation, and that further, these stable emulsions could be broken by adding certain organic acids to the mixture; the difficulties were also overcome by washing the acid-treated and caustic-neutralized oil with water before phenol treating. (3) The corrosion of equipment that occurred in the phenol plant, due to excess water, sulphuretted hydrogen or organic acids, had been overcome by the use of cast-iron shells for exchangers and brass condenser tubes; by using high-chrome steels for the recovery coil, which was

(Turn to page 233, please)



Yale Laboratory

By H. E. Blank, Jr.

AUTOMOTIVE engineering at Yale dates from the installation of a chassis dynamometer in Mason Laboratory in 1913 by Prof. Edwin Hoyt Lockwood, who was mainly responsible for initiating research work on automotive projects and the teaching of automotive engineering at Yale. However, the first course was listed in 1915 as "Automobile Engineering" and was taught for two years by D. B. Prentice, now President of Rose Polytechnic Institute.

The course in automobile engineering was taught by Dr. Lockwood from 1917 until he died in 1930. He received his academic education at Yale and advanced from an instructorship in the department of mechanical engineering at the Sheffield Scientific School to the Robert Higgin professorship in 1927, the position which he held at the time of his death. Among the many subjects on which he was recognized as an authority were automobile-tire rolling resistance, automobile-engine performance, automotive-radiator capacity, and air resistance. Some of the many investigations which he personally conducted at Yale were concerned with the rotary-valve internal-combustion engine, gasoline engine carburetors, heat transmission in automobile radiators, and studies of the power and efficiency of the automotive vehicle. Much of his work has been published and his investigations into chassis friction losses were reported in AUTOMOTIVE INDUSTRIES. Conversation of engineering faculty men at Yale often swings to Dr. Lockwood, praises his research successes and many talents—not the least of which was a remarkable intuition. "Lockwood," they say, "could accomplish things with a shoestring and nail for equipment where others would fail despite elaborate and modern test facilities."

The laboratory equipment available for automotive work in the Mason Laboratory of Mechanical Engineering includes four electric dynamometers of 7, 40, 75 and 150 hp. capacity. The two larger ones are used mostly for testing multi-cylinder engines which can be coupled to either end of each dynamometer.

The other two dynamometers are used in conjunction with two single-cylinder Waukesha variable-compression engines. One of these is the stand-

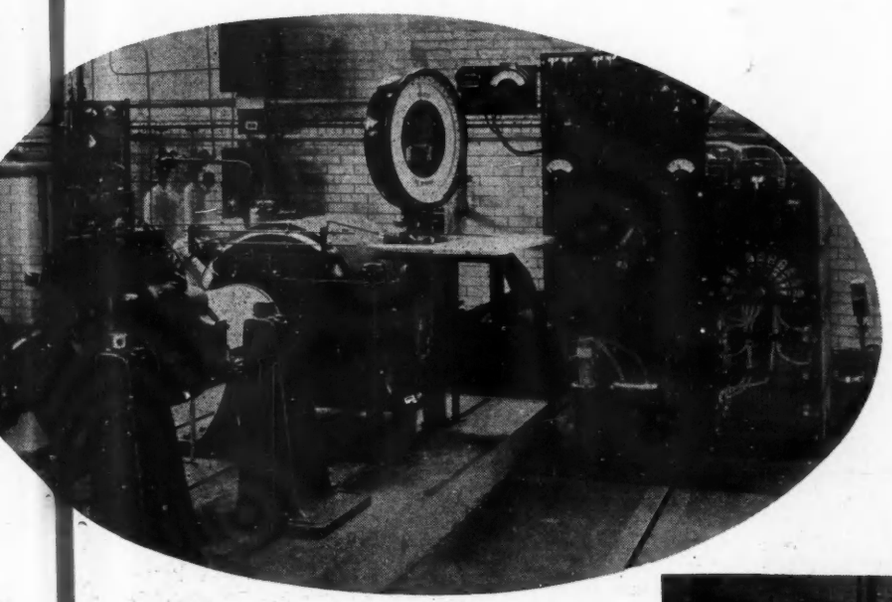
From a modest beginning in 1913 Yale has steadily broadened the scope of its automotive research. This is the second of a series of articles describing facilities for research in educational institutions

ard C.F.R. - A.S.T.M. knock - testing unit, while the other is a compression-ignition engine. Both of these units are operated with constant speed synchronous induction motors as well as the electric dynamometer, depending on the nature of the test work. It is believed at Yale that the C.F.R. engines are excellent pieces of equipment for class instruction and research purposes as well as for knock rating of fuels.

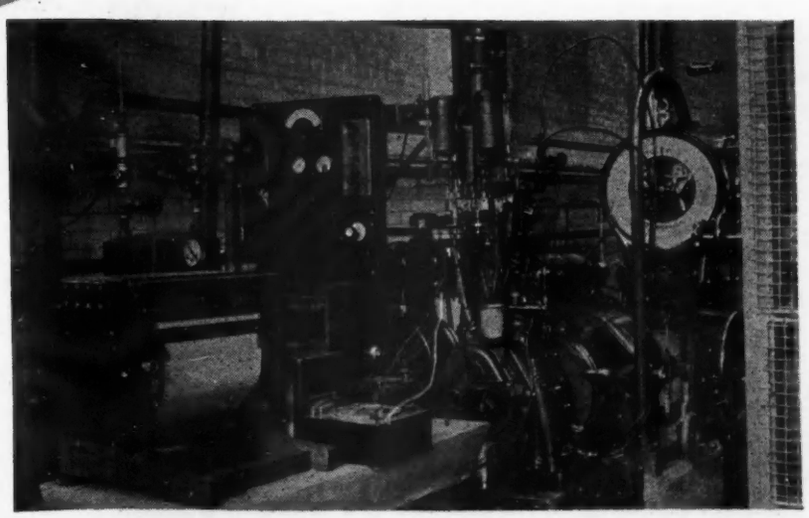
A Maxim silencer is located in the exhaust system conducting exhaust gases to the roof of the laboratory building. Facilities are provided for making fuels and lubricants analyses; also a number of other automotive and airplane engines and their parts, as well as cutaway chassis, are used for undergraduate instruction. Four automotive engines now available for test purposes include two Chevrolets, a 1929 and 1935 model, a 1927 model Chrysler and a 1930 Lycoming eight-cylinder, 125 hp. engine.

Still in service is a piece of equipment which has been subjected to almost continuous usage at Yale—a chassis dynamometer. It was originally built for the Automobile Club of America and purchased for Yale by Walter Seligman in 1913 when the A.C.A. decided to give up chassis testing. In 1932, through the generosity of Briggs Cunningham, new drums were made for the machine and, with other changes, it is now capable of absorbing 200 hp. and operating at a speed of 150 m.p.h.

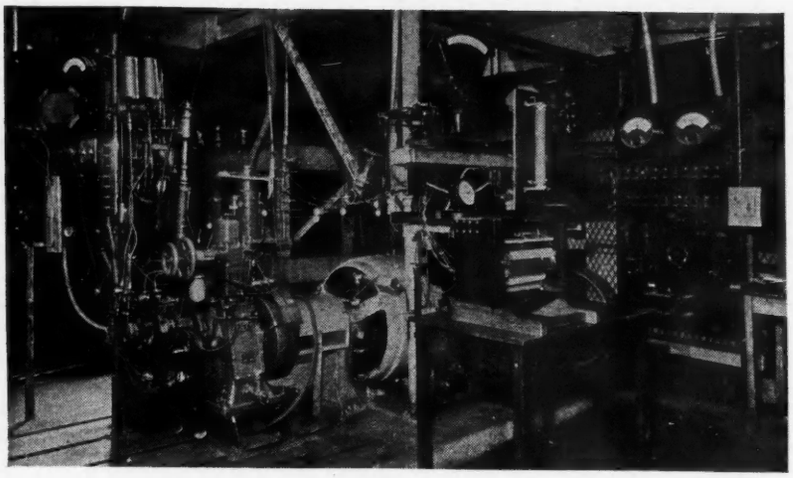
The educational policy of the Yale School of Engineering is to teach fundamentals of engineering and to develop the analytical ability of the student. It is believed that this policy



(Above) 150 hp. electric dynamometer test stand



(Right) C.F.R. engine setup for gasoline-alcohol research by Eugene J. Ziurys



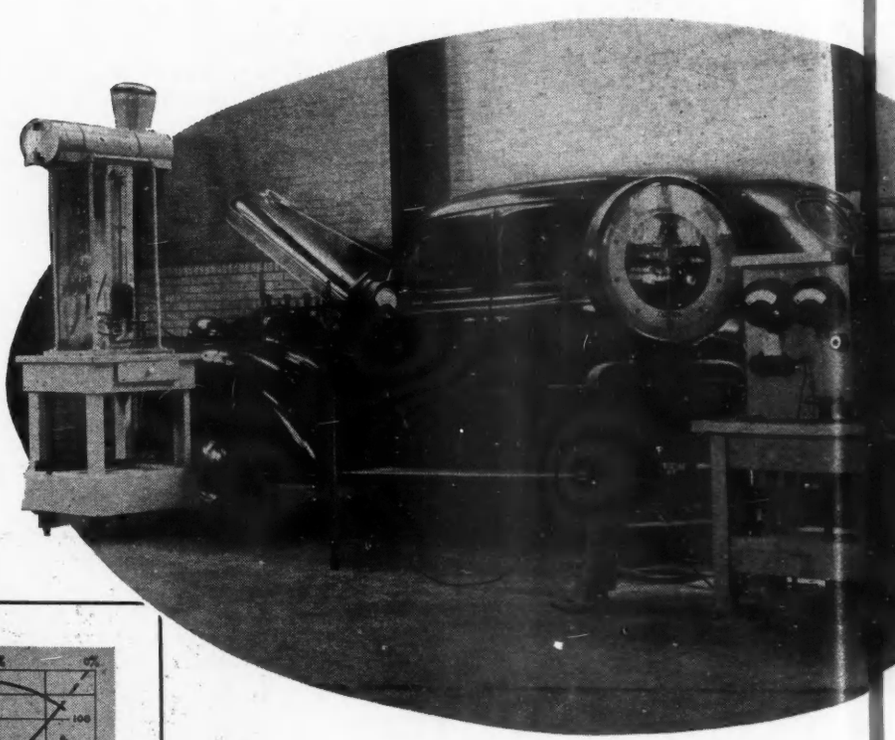
Variable-compression, compression-ignition engine on test stand

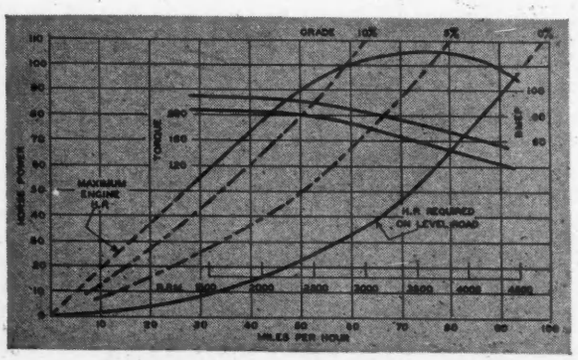
rather than one of specialized training better prepares the student for work in any field of engineering. Thus, no complete specialized course in automotive engineering is given. However, a one-year course is offered as an elective for any undergraduates interested in this branch of engineering. This course is devoted largely to laboratory exercises and report writing. Its purpose is to develop the thinking ability of the student. It accomplishes this by using the automobile and its engine to illustrate the fundamental principle of conversion of energy. The imparting of factual knowledge is of secondary consideration. Also, the undergraduate may elect a course in experimental engineering in which he is given some elementary research problems in the automotive field.

Probably one of the tests which arouses the greatest interest on the part of the undergraduates is the complete test on the chassis dynamometer of an automobile which may belong to one of the students. Curves showing results of a typical test made on the chassis dynamometer are reproduced at the bottom of this and the next page.

Graduate students take courses in advanced automotive engineering, internal combustion engines, and advanced experimental engineering. They are required to do either analytical or experimental research and produce a thesis on the subject investigated. In automotive research, the work usually deals with a phase of automotive engineering in which the student is particularly interested; in many cases with problems that originate with industrial organizations.

An idea of the scope of the research at Yale by graduate students can be obtained from the following named investigations performed in the past few years. Detonation as a factor in combustion chamber design was studied back in 1930 by Earl R. Pierce, now with General Motors Research Corporation. This investigation sought to correlate and crystallize conceptions of detonation and its effect upon design of the combustion chamber of engines operating on the Otto cycle. The following year operating characteristics of piston rings were investigated by Henry L. Kohler, now with Sealed Power Corporation. Then C. W. Phelps, Connecticut State College, made a study of a proposed non-fluid fuel for internal combustion engines. In 1933 Daniel C. Cutter, Standard Oil Company of Cali-





Results of Chassis-Dynamometer Test

(Shown by groups of graphs at bottom of this and facing page)

1936—8-cyl. Sedan V-Type Engine
Bore 3⅜ in., Stroke 4½ in.
Compression Ratio 6.25 to 1
Gear Ratio 4:1 Tire Size 7:00 by 16
Weight, 4200 lb. (without passengers)
Engine rated hp. before installation in car, 125 hp. at 3400 r.p.m.

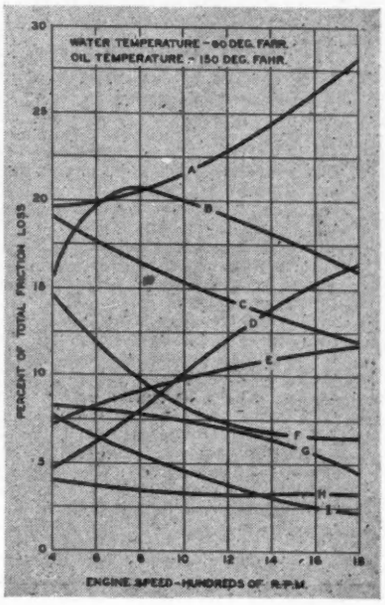
fornia, made a study of and analysed blow-by in the internal-combustion engine and developed a method for accurately measuring blow-by.

G. B. Carson, Case School of Applied Science, developed a method for separating and measuring the friction losses of the component parts of an internal combustion engine. The curves reproduced at the top of this page show the segregation of friction losses measured under one set of operating conditions.

Further studies include those of R. F. Gagg, Wright Aeronautical Corporation, on improvement of cycle; R. W. Young, Wright Aeronautical Corporation, on supercharging aircraft engines; L. M. Porter, New York University, on truck transmission efficiencies; H. H. Dedo, Ethyl Gasoline Corporation, on effect of engine torques on airplane drag; R. R. Faller, Ethyl Gasoline Corporation, on detonation temperatures; J. T. Marshall, Eclipse Aviation Corporation, on use of exhaust energy for charging two-cycle engines; W. A. Gebhardt, Bendix-Stromberg Carburetor Company, on losses in a dual-ratio rear axle; and W. E. Drinkard, Chrysler Corporation, on performance characteristics of automobiles.

Curves showing segregation of friction losses in accordance with the method developed by G. B. Carson

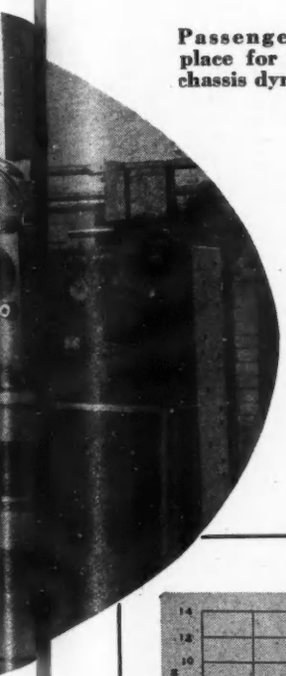
A—Pumping
B—Center Piston Ring
C—Connecting Rod and Wrist Pin Bearings
D—Oil Ring and Piston
E—Crankshaft, Camshaft and Timing Gears
F—Top Piston Ring
G—Piston Sidewall Friction Due to Compression
H—Valve Mechanism
I—Accessory Drive Gears

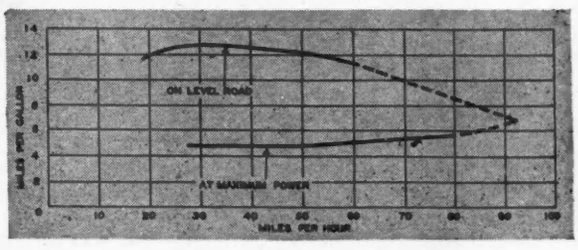


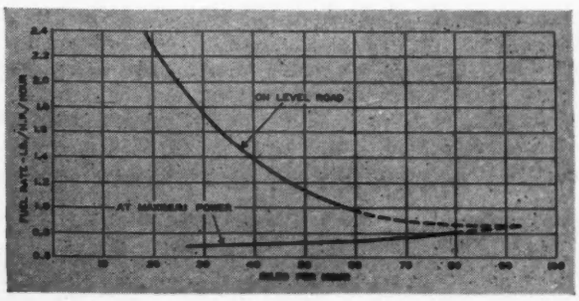
Some work on alcohol as a fuel for internal-combustion engines, which is of practical as well as scientific interest at the present time, began with the work of Eugene J. Ziurys, now with Ethyl Gasoline Corporation. His work dealt with a comparison of the performance of commercial ethyl alcohol and gasoline in single-cylinder and multi-cylinder engines under various operating conditions. Later, C. W. Phelps, Connecticut State College, extended the work to include blends of 10 and 20 per cent of anhydrous denatured as well as absolute ethyl alcohol and gasoline. He also made a study of the effect of the alcohol in the blends upon the constituents of the exhaust products obtained under various conditions of operation. The results of these tests show no appreciable gain in power by substituting either alcohol or alcohol-gasoline blends for gasoline, the alcohol fuels requiring lower air-fuel ratios for maximum power outputs. The fuel rates are considerably higher with the alcohol fuels, depending on the blend, when compared at maximum power outputs or other comparable air-fuel ratios. Analysis of the exhaust gases showed the health hazard is not eliminated under normal conditions with the use of the alcohol blends.

Research projects under way at the present time include some work started by G. F. McDermott, a graduate student, dealing with the relation between spontaneous combustion characteristics of fuel-air mixtures and their tendency to detonate. Also Wm. F. Fenney, a graduate student, is studying the compression-ignition engine, its combustion process and the rating of fuels for this engine.

Passenger car in place for testing on chassis dynamometer







Herbert Walter Best, assistant professor of mechanical engineering, received conventional academic education with a B.S. in general engineering from the Massachusetts Institute of Technology in 1921 and the degree of Mechanical Engineer from Yale, awarded in 1933. The high-spot history of his non-academic experience is a definite departure from average; pilot and flying instructor, ensign U. S. Naval Reserve Force; tire sales and service representative for the Miller Rubber Company in Santiago, Chile, South America; a bout of pipe fitting for the Grinnell Sprinkler Company; laboratory assistant of the International Motors Company, where he rose in three years to assistant experimental engineer. In 1927 he joined the staff of the Sheffield Scientific School as instructor in mechanical engineering. He was appointed to his present position in 1933.

He was co-author of "Anti-Knock Research Coordinates Laboratory and Road Tests," a paper presented at the S.A.E. annual meeting in Detroit in January, 1933. Other research projects at Yale in which he has participated include: investigation relative to brake legislation, done in conjunction with Professor Lockwood; performance of 1928 cars; report on air-fuel ratio tests; correlation of C.F.R. laboratory knock ratings with behavior of motor fuels in service.

Herbert Walter Best

Lester Clyde Lichty

Lester Clyde Lichty, associate professor of mechanical engineering, obtained his B.S. in M.E. at the University of Nebraska in 1913, his M.S. in M.E. at the University of Illinois in 1916, and his M.E. from Yale in 1924.

He began teaching mechanical engineering at the University of Oklahoma in 1916. In 1923 he left Oklahoma U. to do graduate work at the Sheffield Scientific School, Yale, which was followed by joining the teaching staff. The associate professorship was conferred on him in 1930.

His non-academic experience includes engineering work with a public utility, appraisal work in an artificial gas plant and also in a chemical plant, and supervision of the installation of a water works system.

He was a First Lieutenant in the Air Service, in Charge of the Transportation Department of the Air Service Mechanics School, Kelly Field, which was followed by a connection with Whiting Motor Company (Mercer) as service manager of their Newark Branch, before returning to teaching.

The list of research projects in which he has participated is lengthy and covers a wide diversity of subjects. His work on energy distribution in the internal combustion engine was described in AUTOMOTIVE INDUSTRIES, September, 1934. Most recently published of his works is that dealing with Gasoline, Alcohol, and Blends of the two, done in cooperation with E. J. Ziurys and C. W. Phelps. June last year his new book on Thermodynamics was published. He has twice revised a text on Internal Combustion Engines, originally written by R. L. Streeter, deceased, which is widely used in the engineering schools of this country.

Mason F. Smith, research assistant in mechanical engineering, obtained his Ph.B. at Yale in 1897, and has been connected with the faculty since then. He was first Assistant Astronomer in the Yale Observatory, and later Astronomer in Charge at the Observatory.

In 1918 he transferred to the mechanical engineering department, and assisted Professor Lockwood in practically all of his automotive work. He was co-author with R. R. Faller (Ethyl Gasoline Corporation) and L. C. Lichty in a published paper dealing with a study of the combustion process in the internal combustion engine. He has participated in most of the automotive research done at the Mason Laboratory, particularly that on the chassis dynamometer.

Commercial testing at Mason Laboratory is not encouraged except as a measure of cooperation in the public interest or for the benefit of the teaching and research program. Under no circumstances may commercial work be solicited in competition with practicing engineers, laboratories or firms engaged in this business.

Particularly noteworthy is the cooperative work dealing with fuel research at Yale. The university obtained membership on the Detonation Subcommittee of the C.F.R. in 1931 and since then has been actively engaged in cooperative work at the Mason Laboratory and other places, such as Uniontown, Pa. It will be recalled that the C.F.R. motor method for rating gasolines was the result of the foregoing work in which 14 laboratories of the petroleum and automotive industries, the Bureau of Standards, and Yale University cooperated.

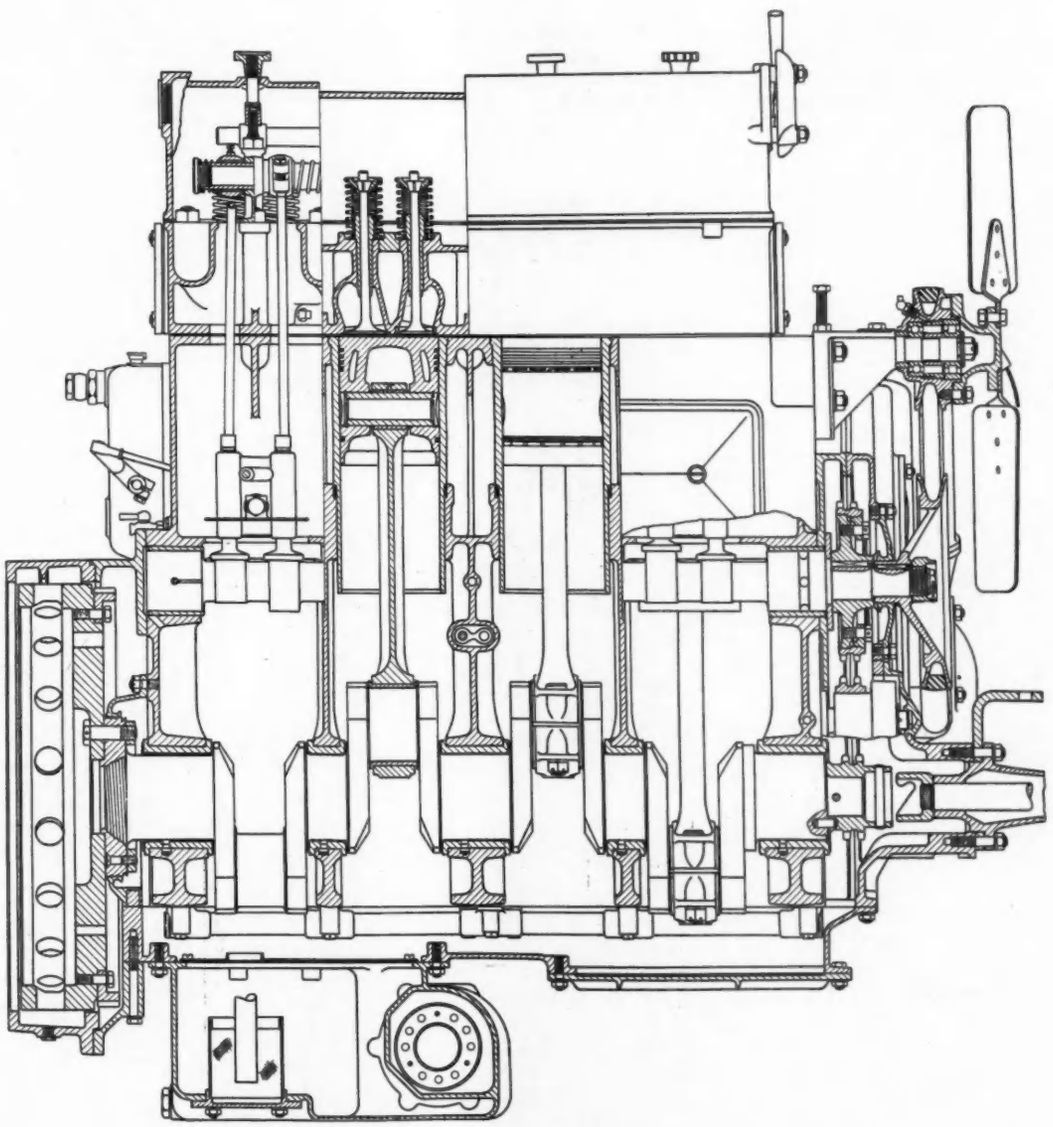
The university participated in the rating of three unidentified exchange samples of gasoline submitted monthly by the various oil companies in a cooperative group of about 20 laboratories, which provides a check on octane rating and also further data for studying this subject.

At present, work at the laboratory is being conducted dealing with the rating of fuels for compression-ignition engines. This is being done in cooperation with the Volunteer Group for Cooperative Research on Fuels for Compression Ignition Engines.

The university is represented on various committees dealing with automotive or fuel activities. Professor Lichty is chairman of Subdivision D of the Lubricants Division, S.A.E., while Professor Best is chairman of the Motor Fuels Committee (formerly Detonation Sub-Committee) of the C.F.R. committee. He has recently been named chairman of the Southern New England Section, Society of Automotive Engineers.

THORNYCROFT . . .

bus and truck type Diesel engine made by John I. Thornycroft & Co., Ltd., Thornycroft House, Smith Square, Westminster, S.W.1, England



No. 39 in the AUTOMOTIVE INDUSTRIES Engineering Drawing Series.

THORNYCROFT . . .

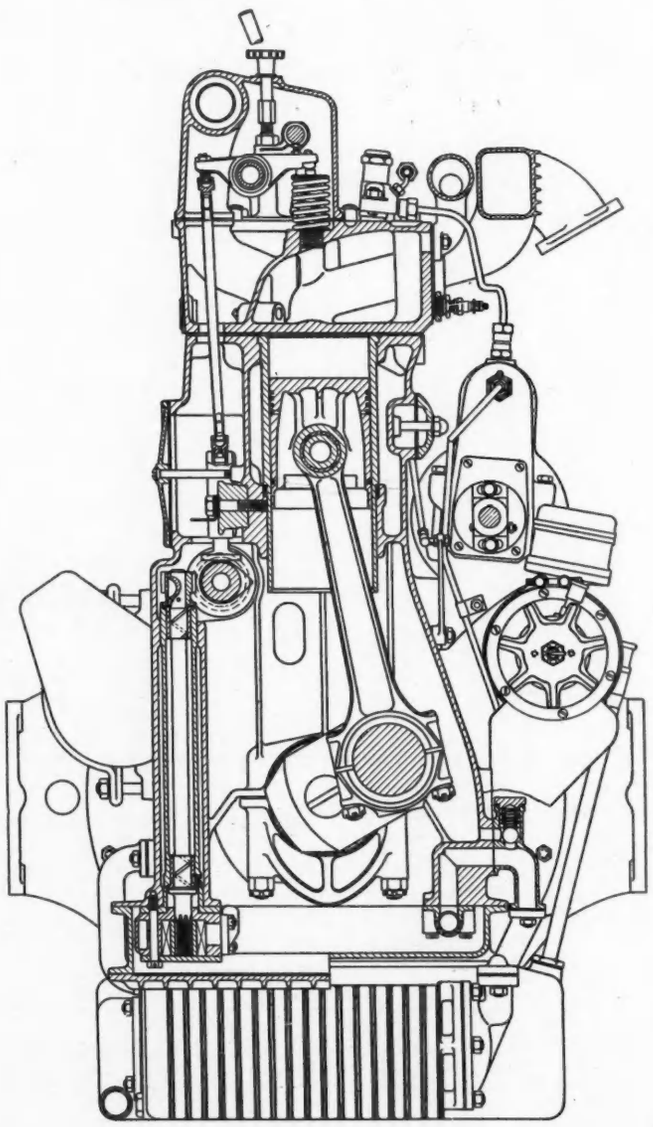
This engine is produced with either four or six cylinders. The four-cylinder type, reproduced herewith, has a bore and stroke of 4⅛ in. by 6 in., making the piston displacement 315 cu. in. Power rating is 85 b. hp. at 2200 r.p.m. Maximum torque is listed at 222 lb.-ft. at 1400 r.p.m.; maximum b.m.e.p. 104 lb. per sq. in. at 1450 r.p.m. The combustion chamber is of the Ricardo cell type. Compression ratio is 16.3 to 1.

Fuel consumption amounts to 0.4 pints per b.hp.-hr. The speed ranges from 400 to 2200 r.p.m. Dry weight of the engine, complete with 24-volt electric starter, totals 1275 lb.

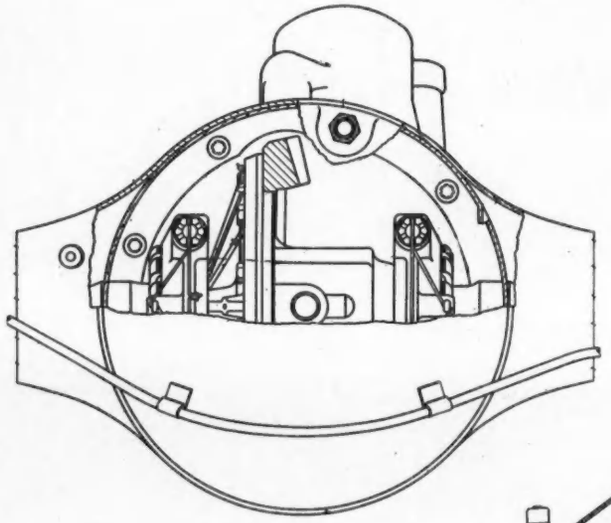
The crankshaft is supported in five bearings: journals, 3½ in. in diameter; main bearings, front, center and rear are 2¾ in. long; intermediate, 1½ in.; crankpins are 3 in. in diameter; big-end bearings 2 in. wide.

The cylinder head is made of cast iron and has inserted seats for exhaust valves. Cylinder block is integral with the cast iron crankcase and has hardened wet liners. Pistons are of aluminum, while connecting rods are made of one per cent carbon steel.

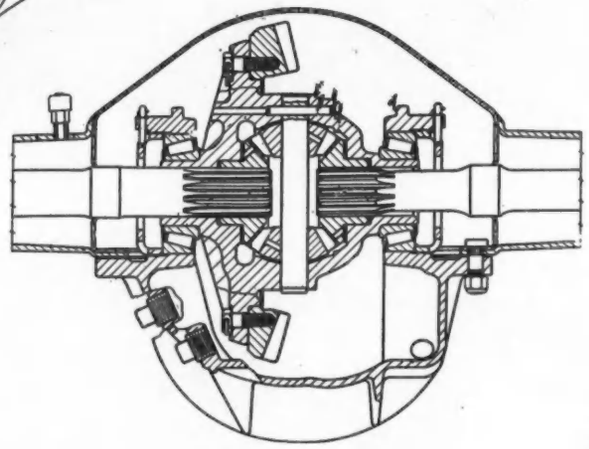
Pressure lubrication is through the ribbed oil cooler forming a separate unit with the sump below the crankcase. Other equipment includes: C.A.V.-Bosch fuel pump and injectors; exhauster for vacuum servo braking.

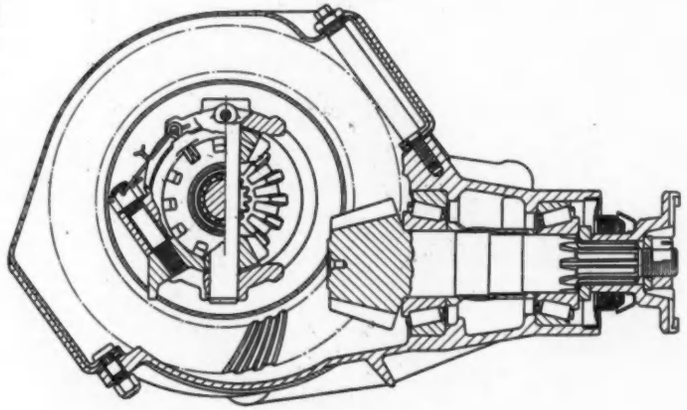


THE PACKARD HYPOID . . .



Six-cylinder model: ratio, 4.36, teeth on ring gear, 48, teeth on pinion, 11; 120C model: ratio, 4.09, teeth on ring gear, 45, teeth on pinion, 11; Super-8 model: ratio, 4.69, teeth on ring gear, 62, teeth on pinion, 14; Twelve-cylinder model: ratio, 4.41, teeth on ring gear, 75, teeth on pinion, 17.





No. 40 in the AUTOMOTIVE INDUSTRIES Engineering Drawing Series.

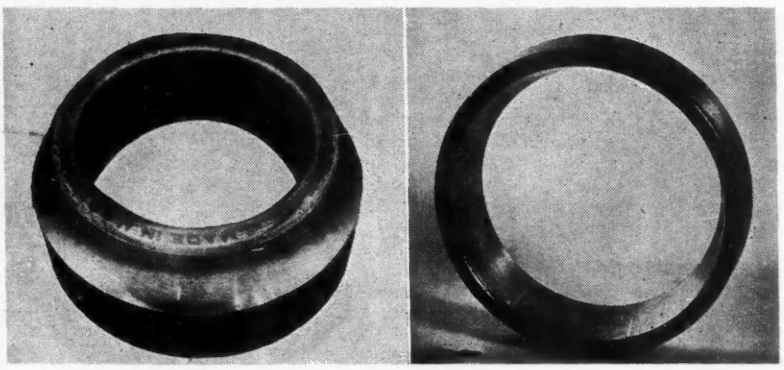


Fig. 1—Examples of (left) ball type and (right) roller type automobile wheel bearings indented

of the wheels due to vibrations of the freight car in which the automobiles were shipped. The race at the left is from a ball bearing and that at the right is from a roller-bearing. Actual indentations in both cases are small, the width of the marks being more a measure of the amplitude of the wheel oscillations than a measure of their depth.

The inner and outer races of an aircraft-engine valve-rocker bearing are pictured in Fig. 2. Here, the number of indentations is larger than the number of balls in the bearing due to shifting of the ball cage relative to the races. These deep indentations were

By J. O. ALMEN*

IN spite of rough usage from high speed, overloads, and infrequent lubrication, ball and roller bearings in automobiles and trucks give little trouble in service. Automobiles will travel tens of thousands of miles without measurable wear of their antifriction bearings, yet these same bearings are often seriously damaged while the automobile is stationary during shipment in freight cars and on trucks. The bearing damage occurring in shipment consists of indentations in the bearing raceways opposite each of the balls or rollers on the loaded side of the bearings. These indentations have the appearance of having been produced by extremely high pressures, and, therefore, the bearings are erroneously said to be "brinelled."

Bearing damage of this type is not confined to automobile road-wheel bearings in freight-car shipments. It has given trouble in installations of many antifriction bearings that are normally at rest and are used mainly to avoid static friction or where the bearings move through small angles. Among these are automobile spring shackles, kingpin bearings and other steering-gear parts. In aircraft engines, valve-rockerarm bearings have, until recently, been subject to this form of damage. Bearings in variable-pitch propellers and control parts have, at times, been so badly damaged as to become inoperative and even the landing-wheel bearings are damaged in flight. In fact, an assembled bearing can be ruined merely by placing it on a vibrating plate.

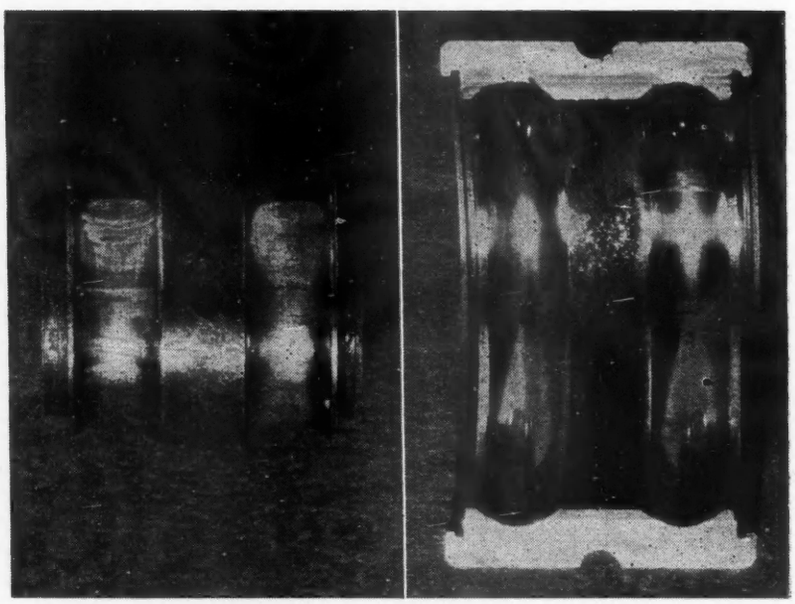


Fig. 2—Aircraft-engine rocker shaft bearing that was damaged in service by engine vibration

Typical Examples of Bearing Indentations

Fig. 1 shows two front-wheel bearing races that have indentations resulting from small-amplitude oscillations formed in periods of rest between valve opning and closing when the bearing carried practically no load but was vibrated severely by the engine. This trouble has been practically eliminated by substituting oil for the grease lubrication previously used.

Fig. 3 shows the main thrust-bearing race and rollers from a variable-pitch airplane propeller. This bearing moves through a small angle in adjusting of the propeller-blade pitch but is stationary most of the time except for the

*Head Dynamics Dept., Research Laboratories Div. of General Motors Corp. at Detroit. From a paper presented to the A.S.M.E.

False Brinelling

. . . of ball and roller bearings in automobiles while stationary has been the subject of much concern. In this and a succeeding instalment the author develops some valuable and interesting data.

vibrations from the blade and the engine crankshaft. The actual damage is again less than appears from the illustration but is still sufficient to be troublesome.

Severe indentations that occurred in the control parts of a variable-pitch airplane propeller are illustrated in Fig. 4. The load on these parts is relatively low, but vibration is severe. Of especial interest in this group, is the small part at the middle left, with the reverse side at the middle right. This part pivoted on a conical-headed bolt, and some movement occurred between the bolt head and the conical seat, which was deeply corroded as a result.

Fig. 5 shows part of a needle-bearing automobile universal joint that was badly indented while operating in a laboratory test fixture. This specimen transmitted 45 hp. at 1000 r.p.m. for 200 hr. The shafts were in direct alignment and, therefore, the movements at the needle bearings were limited to errors in the setup and to deflections of shafts and supports under load. Another test was made with the propeller shaft 1.5 in. out of alignment, in which case the bearings were found to be only slightly indented. In a third test, with the shaft 2.5 in. out of alignment, three of the bearings were undamaged, and the fourth but slightly marked. These results agree with service experience for propeller shafts with various alignments.

In all cases of bearing indentation just enumerated, the fact that the bearings are at rest or have periods of rest and also that vibration is present should be noted. Bearings need not be heavily loaded to produce indentations, although, in general, the greater the load the greater the damage; however, under certain experimental conditions, decreasing damage with increasing load can be shown. Characteristic of indented bearings is a rust accumulation in the vicinity of the damaged area. In practice, this rust is not often observed because rotation of the bearing after a period of vibration quickly mixes the rust with the oil or grease used for lubrication.

Brinelling a Form of Wear

Since this brinelling of ball and roller bearings may occur under conditions of load that are much too low to cause true brinelling, it is clearly not a case of pressure indentation but comes under the general classification of wear. Many experimenters have noticed wear of this type, it being mentioned by E. M. Eden, W. N. Rose, and F. L. Cunningham[1] as early as 1911. Various explanations of its cause have been suggested from time to time. Several of the theories and supporting data presented by earlier investigators are of interest as pertaining to the special case of wear with which we are here concerned.

G. A. Tomlinson,[2] experimenting with the friction of small balls on steel plates, produced oxidation similar to that which occurs in ball and roller bearings. After considering such possible effects as electrolysis, adsorbed moisture, and local heating, he concluded that the damage was caused by tangentially acting cohesive forces lifting out metal particles which were so small that they oxidize instantly. In support of this theory of molecular cohesion, he offers an experiment that can be performed easily. Carefully

[1] "The Endurance of Metals," by E. M. Eden, W. N. Rose, and F. L. Cunningham, Proceedings of the Institution of Mechanical Engineers, 1911, p. 875.

[2] "The Rusting of Steel Surfaces in Contact," by G. A. Tomlinson, Proceedings of the Royal Society of London, series A, vol. 115, 1927, pp. 472-483.

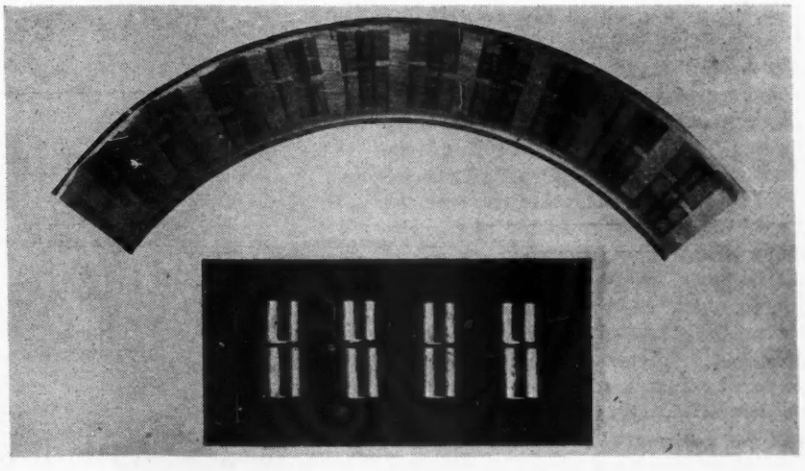


Fig. 3—Main thrust bearing of a variable-pitch airplane propeller

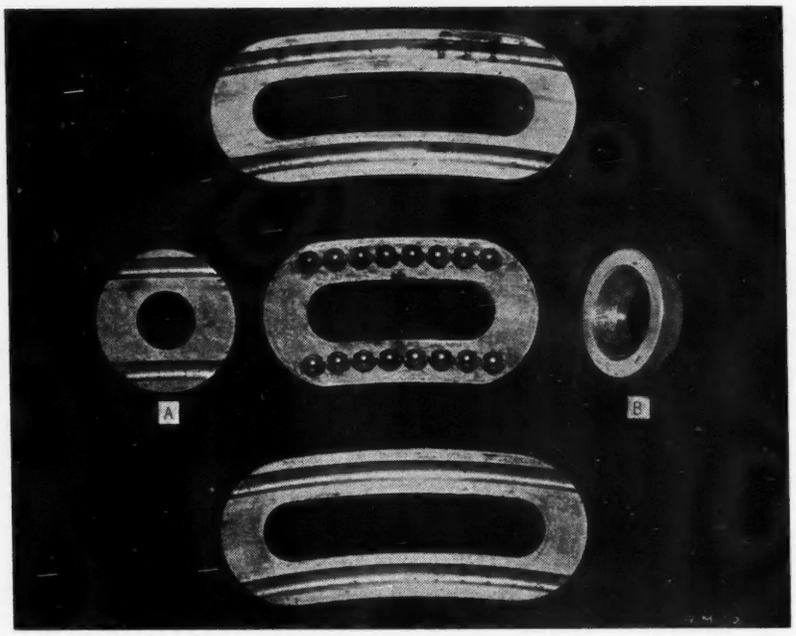


Fig. 4—Example of severe indentation in the control parts of a variable-pitch airplane propeller

clean a piece of plate glass and the surface of a fused glass bead which is attached to a light rod. If the rod be lightly poised in the fingers and allowed to stroke the plate, a series of snatches is felt as the bead "welds" and breaks away from the plate. (His use of the word weld should be noted particularly.) Examining this plate with a lens will reveal that even the lightest touch of the bead to the plate will produce scored dotted lines. Continuing this same experiment with hardened steel surfaces, the sensation of snatching, as the weld is made, is much less marked. Again, examination with a lens will reveal the path by the presence of a thin track of reddish-brown oxide. According to Tomlinson, steel, glass, stellite, and agate all produce the same effect on steel.

Dr. M. Fink,[3] experimenting with an Amsler wear-testing machine, reached the conclusion that wear of the type under discussion is the result of the formation and rubbing off of successive oxide films. The Amsler machine used in these tests consisted of two circular disks geared together to rotate at the same angular velocity and making contact on their peripheries as shown in Fig. 6. By making the disks of different diameters, relative slip of 1 per cent was obtained. The disks used by Fink were 10 mm. (0.3937 in.) wide and 40 mm. (1.5748 in.) in diameter and ran at 250 r.p.m. under a load of 110 lb. In one case, after running in air for 50,000 revolutions, the loss in weight of one disk was found to be 0.1802 g (0.006356 oz.). When this test was repeated in an atmosphere of nitrogen, no wear occurred. He also noted that, when test specimens were run in oxygen-free atmosphere, the rubbing friction was only one-third as great as when they were run in air and that the surface became smooth and bright in contrast to those tested in air which were discolored with oxide films. As a result of these experiments, Fink concluded that oxidation is not a secondary effect, as stated by Tomlinson, but is an essential component of wear. According to Fink, lubricants do not protect the rubbing surfaces against wear oxidation, because they contain dissolved oxygen in sufficient quantity to produce this form of wear.

In 1934, S. J. Rosenberg and L. Jordan[4] of the National Bureau of Standards attempted to duplicate the experiments of Fink, using a similar machine and test conditions. They conducted tests in air and in atmospheres of nitrogen and hydrogen but used a relative slip between their test specimens of 10 per cent instead of 1 per cent as Fink did. Results obtained from these tests were not in agreement with the Fink tests. No appreciable difference was found in the wear, in air and in an oxygen-free atmosphere of nitrogen or hydrogen, of steel specimens having metallurgical characteristics similar to the Fink specimens.

In a discussion of Rosenberg and Jordan tests, Fink says:[5]

"The tests of Rosenberg and Jordan cannot be said to duplicate the tests of Fink since the occurrence of oxidation in their tests is an indication that oxygen-free atmosphere was not used in the cell. (*Turn to page 230, please.*)

[3] "Wear Oxidation, a New Component of Wear," by Dr. M. Fink, Transactions of the American Society for Steel Treating, vol. 18, 1930, pp. 1026-1034.

[4] "The Influence of Oxide Films on the Wear of Steels," by S. J. Rosenberg and L. Jordan, Transactions of the American Society for Metals, vol. 23, 1935, pp. 577-613.

[5] "The Influence of Oxide Films on the Wear of Steels," by S. J. Rosneberg and L. Jordan, Transactions of the American Society for Metals, vol. 23, 1935, pp. 609 and 610.

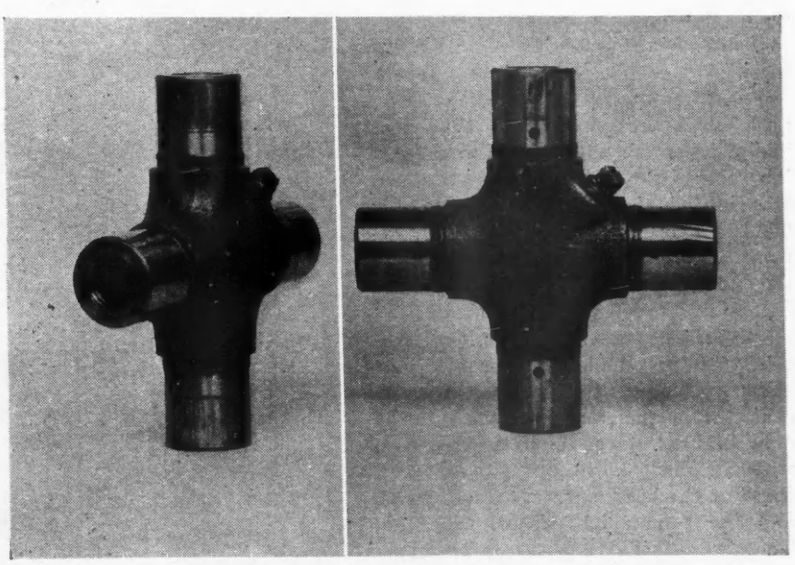


Fig. 5—Universal-joint spider that was damaged while operating in a laboratory test fixture

Standard Atmosphere and Sea-Level Pressures

By L. P. Harrison*

A SENSITIVE altimeter is a device for correlating barometric pressure with altitude under the assumption that the atmosphere conforms to certain specified conditions, which are approximately the average conditions for the year in our latitudes, viz., that the barometric pressure at sea level is 29.92 in. of mercury, the temperature at sea level is 59 deg. F., and the temperature decreases with height in the atmosphere at the rate of 0.003566 deg. F. per foot increase in height until a temperature of minus 67 deg. F. is reached, above which the temperature is assumed to remain constant. An atmosphere which fulfills these conditions is called a standard atmosphere, and each barometric pressure corresponds to a definite height above sea level therein. For example:

	Ft.
29.92 in. corresponds to	0
28.86 in. corresponds to	1,000
27.82 in. corresponds to	2,000
26.81 in. corresponds to	3,000

The altimeter is really a pressure-measuring instrument like an aneroid barometer, with a standard atmosphere altitude scale substituted for the pressure scale. It can therefore only measure barometric pressures.

Actually, at any given time and place the atmosphere may not be identical with the standard atmosphere, since with movement across the country of cyclones and anticyclones (low and high-pressure systems), and air masses of various temperatures, the pressure and temperature conditions depart from the standard. Therefore, in general, a given pressure does not always correspond to the same elevation above sea level. For instance, the pressure at sea level (0 ft.) may be 29.10 in. one day and 29.50 in. the next, or 28.86 in. may correspond to 1000 ft. on one day and to 1300 ft. the next. In order to take into account the variations of barometric pressure, the sensitive altimeter is arranged so that the altitude scale may be shifted to read true height at any given pressure. For instance, if the pressure at sea level is 29.50 in., the altimeter can be adjusted by turning the knob so that it reads 0 ft. (zero elevation) when subjected to that pressure even though it differs from 29.92 in. Similarly, if the pressure at an airport 1000 ft. above sea level is 28.60 in., the altimeter can be adjusted so that it reads 1000 ft. when there subjected to that pressure even though it differs from 28.86 in., which is the "standard atmosphere" pressure corresponding to the given elevation.

To a very close degree of approximation, the difference in height from one level to another in the atmosphere may be computed from: The pressure at the lower level, the pressure at the upper level, and the average temperature of the air in the layer between the levels. Therefore, even though an altimeter may read the true height at the lower level, it will not read the true height at the upper level if the average temperature of the layer does not bear the proper relationship to the temperature conditions used as the basis for the "standard atmosphere."

The altimeter does not have any provision for taking temperature variations into account to obtain more accurate height readings, as is possible with respect to pressure variations.

Adjustment for Pressure Change

The sensitive altimeter, such as the Kollsman type, has a special provision for making the adjustment for pressure variations. This consists of a pressure scale which appears in a cut-out opening near the base of the altimeter dial. An index points to this scale. The pressure value on this scale indicated by the index is the barometric pressure to which the altimeter must be subjected for it to read zero elevation as adjusted at the time.

In practice, it is desired to have the altimeter read true height at a given airport where the pressure near the level of the field is known in some way. This is accomplished by turning the knob on the altimeter until the index points to the "standard atmosphere sea-level pressure" appropriate to the given airport elevation and the pressure just above the airport; that is, the "standard atmosphere sea-level pressure" pertinent to a given airport at a given time is the pressure setting for sensitive type altimeters which will cause the instruments to read the true height of the airport above sea-level when subjected to the existing pressure just above the airport at the given time. This "standard atmosphere sea-level pressure" depends on the "standard atmosphere" relation of pressure to height according to which the altimeter was calibrated, the airport elevation, and the pressure just above the airport. It does not represent the pressure which would exist at sea level under the prevailing meterological conditions, since the actual pressure at a lower level depends on the given pressure at the upper level, the difference in height between the levels, and the average temperature of the layer of air between the levels.

For meteorological purposes, what is desired is the actual pressure at sea level under the prevailing conditions, modified by a slight amount to allow for effects of topography on the temperature and other elements, and to give smooth, consistent isobars on consecutive weather maps. Thus, the "meteorological sea-level pressure" depends on pressure, temperature, topography, etc., whereas the "standard atmosphere sea-level pressure" depends on pressure but not on the remaining factors. The difference between the two types of pressure in question is negligible at low elevations above sea level, but is considerable at higher elevations, especially when the air temperatures depart greatly from the average conditions assumed in the "standard atmosphere." The "meteorological sea-level pressure" is therefore not a suitable substitute for "standard atmosphere sea-level pressure," in general.

*Aerological Division of the U. S. Weather Bureau.

FALSE BRINELLING

(Continued from page 228)

"The use of 10 per cent slip is too great for the softer materials, since, in this case, the component of the removal of metallic particles predominates. . . . In the case of wheels running on rails, a maximum slip of about 5 per cent occurs.

"The field of friction oxidation is concerned with rolling friction with proportionately large surface pressures and small degrees of slip, 50 to 150 kg. (110.23 to 330.69 lb.) and 0 to 4 per cent slip. With sliding friction, the field of friction oxidation is concerned with 100 per cent slip and low surface pressures, approximately 0.5 kg. per sq. cm. (7.21 lb. per sq. in.), thus presupposing unhardened material.

"Oil does not protect against friction oxidation since oxygen is dissolved in the oil."

Probably, the conclusions reached by all these investigators were justified within the limitations of their tests. The apparent contradictions of test results are no greater than have occurred in many other lines of research and can be explained by the differences in test conditions. A similar situation occurred a few years ago in regard to tests of extreme-pressure lubricants. In this case, S. A. McKee, E. A. Harrington, and T. R. McKee[6] of the National Bureau of Standards conducted comparative tests and obtained widely different results for each of four test machines. They, therefore, built another machine from which a fifth set of results was obtained. Differences between the five machines were the relationship of such variables as rubbing speed, heat dissipation, specimen hardness, specimen finish, and rate of load application. Since the lubricants under test were primarily intended to lubricate automobile rear-axle gears, the important point was to determine the relative merit of lubricants in rear axles in which the relationship of the variables was not the same as in any of the laboratory test machines. The real problem was to determine which of the machines most nearly graded the lubricants in the order that these lubricants were graded by automobile rear axles in service.

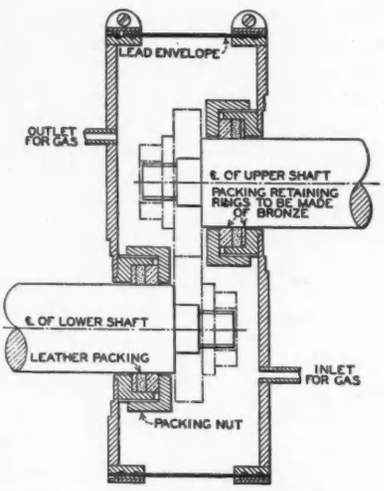


Fig. 6—Amsler wear-test machine used by Dr. Fink in his tests on wear oxidation.

These tests are mentioned merely to emphasize the difficulty of interpreting laboratory-test data. The conditions prevailing in practice can rarely be reproduced or even approximated in the

[6] "Load-Carrying Capacity of Extreme-Pressure Lubricants," by S. A. McKee, T. A. Harrington, and T. R. McKee, S.A.E. Transactions, vol. 28, 1933, pp. 217-223.

laboratory, and first determining what happens in service and then varying the laboratory test procedure or equipment until results are obtained that are similar to those found in service is, therefore, of utmost importance in industrial work.

When the results obtained by Tomlinson, Fink, and the National Bureau of Standards are compared with the brinelling of ball and roller bearings in service, Fink's theory of wear oxidation appears to meet most nearly the requirements. This does not mean, however, that wear of other machine parts in service can be explained by this theory. In fact, the wear destruction of gear teeth by scoring in service seems to agree not with the Fink theory but with the weld theory of Tomlinson. Likewise, cases are known where an oxide film on rubbing parts is beneficial.

Part Two Will Appear In An Early Issue.

Plant Notes

(Continued from page 205)

and south under McKinley Street and connecting the Centrifuse plant with the hub shop extension, will house a conveyor on which the rings will travel to Plant No. 2 after they have been machined. Here the drums and hubs for both passenger cars and trucks will be assembled and the finished product made ready for equipment.

Chain Belt Co. of Milwaukee has just completed the erection of a new building at its West Milwaukee Works to house the machine shop and the West Milwaukee offices. All machine operations except the assembly and manufacture of steel and malleable chains and the finishing of sprocket wheels are being moved from the Milwaukee Works to the West Milwaukee plant. As a result of this move, more manufacturing space is made available for the production of conveyor and drive chains and sprockets. Other machine operations will now be closer to the construction equipment plant and the conveyor plant, the principal departments served. Here also will be located the spray nozzle shop and the Rex Stearns idler shop which was moved to Milwaukee from Cleveland some time ago and which has outgrown its former location. The Milwaukee works now consist of the main offices, the chain division, and a gray iron foundry; while at West Milwaukee are located the malleable foundry, the construction equipment division, the conveyor division, the research department, and the principal production offices.

Wisconsin Grey Iron Foundry Co., Milwaukee, which has for several years operated in leased space is moving into new quarters doubling its floor space to 58,000 sq. ft., having purchased the gray iron shops of the old National Brake & Electric Co. from the Westinghouse Air Brake Co., Pittsburgh. The former quarters are owned by the J. I. Case Co., Racine, Wis., maker of tractors and farm machinery, which is contemplating its reopening soon.

Ladish Drop Forge Co., Cudahy, suburb of Milwaukee, maker of forgings for automobiles, trucks, tractors, etc., is installing 23 large exhaust fans in its main forge shop, 840 ft. long, to provide mechanical ventilation and improve working conditions. It is said to be the first large-scale air-conditioning program in the American forging industry. The system provides 52,500,000 cu. ft. of fresh air per hour. The fans, manufactured by the Hartzell Propeller Fan Co., Pittsburgh, under the trade name of Charavay, are equipped with Allis-Chalmers electric motors, and controls made by the Square-D Co., Detroit and Milwaukee.

Modern Grinder Mfg. Co., Milwaukee, established in 1912 to manufacture hand and mechanical tool grinders, vises and more recently hydraulic lifting jacks, has completed removal of its plant and offices to Fond du Lac, Wis., where it is occupying 80,000 sq. ft. in the former Gurney Refrigerator Co. plant at Forest Avenue and Brooke Street.

Globe-Union, Inc., Milwaukee, maker of spark plugs, storage batteries, radio parts and roller skates, has purchased the large area shop buildings of the old Milwaukee Air Power Pump Co. and Combustion Oil Burner Co., adjoining its plant, from the Heil Co., which acquired the pump and burner businesses about six years ago and has since transferred these operations to its main works. Globe-Union has occupied the greater part of the air-power and combustion shops under lease for several years.

Supercharging for Small Displacement

AN investigation of the fundamentals of supercharging made by the research department of the Ethyl Gasoline Corporation, Detroit, is really one phase of a comprehensive project relating to methods of increasing the specific output of engines, the other phase being the use of extra high compressions, up to 10 to 1. It has been found that with a "boost" of 13½ in. of mercury column the output of an engine can be doubled, while the specific fuel consumption remains substantially the same. With increase in supercharge there is, of course, an increasing tendency of the engine to knock, and the compression ratio of the engine itself was therefore reduced until the knock disappeared. The lower compression ratio corresponds to a lower expansion ratio, from which a lower cyclic efficiency would be expected, but the fact that the specific fuel consumption remained the same indicates that this loss in cyclic efficiency was balanced by a gain elsewhere. This gain is due to a proportional decrease in the friction losses. Cylinder and bearing friction remain substantially the same when supercharging as when operating with atmospheric induction, and as the power output is twice as great, the proportional friction loss is substantially halved.

From the work so far done the conclusion has been arrived at that supercharging is the answer to the problem of a lot of power in a small space. It entails a lot of metallurgical and ceramic problems, but solutions for both of these problems are known right now. Supercharging adds to the flexibility of the powerplant and it seems to have its greatest possibilities where abnormal power requirements must be met occasionally for short periods of time.

In the tests with extra high compression ratios, use is made of the new 100-octane aircraft fuel, and for the highest compressions used, more than the normal addition of ethyl fluid is required by this super fuel to assure knockless operation.

The investigation referred to in the foregoing is still in its early stages. When it is completed the results will be published and thus made available to the industry generally.

Aluminum-Alloy Heads Tested

AT the Bellevue National Research and Experimental Laboratory of the French National Liquid Fuels Department some tests were made bearing on the advantages of aluminum-alloy cylinder heads from the standpoints of engine output and fuel economy. The tests were carried out on a Citroen four-cylinder 8-hp. automobile engine (2.67-in. bore, 3.94-in. stroke, 89 cu. in. displacement). Tests were carried out first with the stock cast-iron head with a compression ratio of 5.72, then with an aluminum-alloy cylinder head with a compression ratio of 5.95, and finally with an aluminum-alloy head with a compression ratio of 6.5. Making the usual atmospheric corrections, it was found that the aluminum head with 5.95 compression ratio gave an increase of 2 per cent in maximum power as compared with the original cast-iron head, while the aluminum head with a compression ratio of 6.5 gave an increase of 1 per cent in power over the cast-iron head and that only over the lower half of the speed range, there being no increase in output over the upper half. The hourly fuel consumption was approximately 2 per cent greater with the aluminum heads.

Analyses of the exhaust gases indicated that in the tests with 5.95 com-

pression-ratio aluminum head the mix ture was slightly richer and with the 6.5 compression-ratio aluminum head slightly leaner than with the cast-iron head. Previous tests had shown that increase in the richness of the mixture with the aluminum head with 6.5 comcompression ratio reduced the power by about 2 per cent and increased the specific consumption between 2 and 3 per cent. A reduction in the richness of the mixture in the engine with aluminum head and 6.5 compression ratio reduced the power about 2 per cent and had no noticeable effect on the specific consumption. All tests were made under the conditions of optimum spark advance and without perceptible knock. —*Revue de l'Aluminium.*

Alvis Aircraft Engine

A NEW addition to the British air industry is the Alvis aircraft engine factory at Coventry. It will produce aircraft engines for both civil and military planes. Work on the factory was begun in November last and operations began in April. When the plant is in full operation, more than 1000 will be employed. Only large supercharged engines are built at the plant, based on the designs of the French Gnome-LeRhone Co., suitably modified to comply with British Air Ministry requirements. The present program covers four models, as follows: A double-bank 18-cylinder radial engine, medium supercharged and rated at 1300 hp.; a double-bank 18-cylinder radial engine, fully supercharged and rated at 1225 hp.; a double-bank 14-cylinder radial engine, moderately supercharged and rated at 1000 hp., and a double-bank 14-cylinder radial engine, fully supercharged and rated at 1000 r.p.m. The test house of the new plant is equipped for testing engines of up to 2500 hp. without inconveniencing residents of the neighborhood by noise.—*The Engineer.*

Phenol Treatment of Lubricants

(Continued from page 217)

kept at 650 deg. F.; and in the recovery tower by adding hydrated lime to the extract, high in organic acids, charged to the recovery coil. An attempt made by coating the bubble plate with acid-resisting alloys was, however, unsuccessful because corrosion occurred between the alloy and the plate and the protective layer peeled off. (4) Large cumbersome treating apparatus had been eliminated by replacement with flexible centrifuges or simple countercurrent towers.—*Engineering.*

Centrifugal Fusing Formed

(Continued from page 209)

In announcing formation of the new manufacturing concern, Wagner said: "The Centrifugal Fusing Company has leased the plant recently completed by the Motor Wheel Corporation and designed and equipped by the Campbell, Wyant and Cannon Foundry Company for the manufacture of heat, friction, chemical and abrasion resisting alloyed metal products centrifugally fused. The plant has been equipped with machinery designed specifically for the production of these products and is the only plant of its type in the world so far as I know.

"Experimental operations have been conducted for some time and we are now ready for full production with a capacity of over 30,000 tons of centrifugally fused iron a year. We are operating under lease from the Motor Wheel Corporation and also under licenses from the Campbell, Wyant and Cannon Foundry Company which controls numerous patents giving us complete patent protection. The most recent of these were issued July 6, this year, and bear the following patent numbers: 2,085,726, 2,085,727 and 2,086,021.

Here's Insulation that **Stands the Gaff!**

THERE are few places where ignition insulation is subjected to the same extreme conditions as in magnetos on farm tractors. It must serve dependably in spite of direct exposure to spring, summer and autumn storms; to dust, oil, heat, severe vibration and electrical stress.

Because of its unusual combination of useful properties, Bakelite Molded fully meets these difficult requirements. For example, in the International Harvester Company high tension magneto, pictured, Bakelite Molded is successfully employed for complete forming of distributor heads and secondary lead-outs. Due to combined temperatures of sun and engine heat, a special, heat-resistant type of the material is employed.

Typical advantageous characteristics of Bakelite Molded include: high weight-strength factor, electrical resistivity and dielectric strength; and unusual resistance to moisture, oil, solvents, heat and impact. For special uses, there are special types of Bakelite Molded in which one or more of these characteristics are present in advanced degree.

We invite you to consult our engineers regarding most suitable types of Bakelite Molded for any specific application. Also write for useful reference booklet 10M, "Bakelite Molded."

(Above) International Harvester Co. high tension magneto installed in modern farm tractor. (Left) Secondary lead-out and two types of distributor head employed in these magnetos. Each part completely formed in one press operation from durable Bakelite Molded. Molded by Reynolds Molded Plastics.

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THE MATERIAL OF A THOUSAND USES